

**Contesting Risk, Expertise, and Environmental Justice on the Fenceline: The Cases  
of the Navajo Nation, Radford Arsenal, and Camp Minden**

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# **Contesting Risk, Expertise, and Environmental Justice on the Fenceline: The Cases of the Navajo Nation, Radford Arsenal, and Camp Minden**

Gregory Douglas Nelson

## **Abstract: For Scholarly and General Audiences:**

This dissertation examines the contestations over the politics of knowledge, risk, and environmental justice in three fenceline sites. Mobilizing the fenceline standpoint to study risk strengthens our objective understanding of the social situatedness of risk. To illustrate how a fenceline standpoint contributes to stronger objectivity of risk contestations, I survey public discourse of coal slurry extraction in Black Mesa, Arizona using an environmental justice framework. Discursive justifications for the construction of the slurry pipeline reveal how environmental injustice in the fenceline community emerged through urban controversies over water and power generation that excluded a fenceline standpoint. Insights from Black Mesa frame the next two cases: open burning hazardous waste at Radford Army Ammunition Plant, and M6 Disposal at Camp Minden, Louisiana.

At Radford, scholar-activist research examines the contestations of risk at one of the most hazardous facilities in the nation. I analyze the construction of risk from open burning of hazardous from a fenceline standpoint. I discursively situate the controversy over fenceline community risk from open burning, by showing the inadequacies of official risk assessments. Critical discourse analysis of risk shows the extant contestations over the practice of open burning.

In juxtaposition to Radford, the Camp Minden open burn controversy demonstrates how a fenceline movement successfully constructed alternatives to open burning. Fenceline success in Minden is forcing scrutiny over the risks produced by the practice of open burning explosives across the United States. The activation of fenceline knowledge and expertise, through grassroots organizing, is propelling inquiry from scientific and technical experts of the American Chemical Society who are questioning why the Department of Defense and the Environmental Protection Agency have approved the use of open burning at other sites despite safer alternative technology.

Synthetically, each case illustrates the importance of fenceline knowledge as a crucial site of expertise. I present an argument for how a fenceline standpoint can challenge regulatory and producer constructions of fenceline risk. The creation of a program of research: Critical Risk Analysis, offers a model for scholar-activist intervention on the fenceline. The Camp Minden Dialogue demonstrates a successful example of how fenceline expert-activists can influence the construction of risk. Normatively, I build the argument that environmental justice research within Science and Technology Studies ought to situate the fenceline standpoint as equal to the competing epistemological claims of production and regulatory experts in order to strengthen the objectivity of our research in contested fenceline sites.

## **Dedication**

This work is dedicated to the victims of the April 16, 2007 Virginia Tech mass shooting and all others who have suffered from energetic explosive materials and fossil fuel extraction. I was a member of the Class of 2008 in the International Studies and Foreign Languages Departments at Virginia Tech during this tragic event that particularly affected our departments. I dedicate this dissertation to Jocelyn Couture Nowak whose long conversations in French during high school helped to inspire my scholarly endeavors.

This work is dedicated to indigenous peoples struggling on the frontlines of mineral resource colonialism. It is dedicated to all the victims of relocation and cultural genocide waged by Peabody Coal Company on Black Mesa, Arizona.

Finally, this dissertation is dedicated to my parents, Dr. Douglas James Nelson and Angela Nelson whose support, sacrifice, and resilience made me possible.

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# Contesting Risk, Expertise, and Environmental Justice on the Fenceline: The Cases of the Navajo Nation, Radford Arsenal, and Camp Minden

## Chapter 1: Introduction and Methodology

### *Framing Three Cases of Expertise: Knowledge and Risk on the Fenceline:*

Despite significant developments in the productive capacity of humankind through socio-technical improvements fenceline residents of industrial systems live with and amidst negative externalities of scientific and technological production. Those closest to the fenceline of a mining operation, power generation, or petrochemical facility experience risk from production differently than those who inhabit regions far from the fenceline of industrial sites. Fenceline communities, by their proximity experience risk in unique ways.

Unevenness of experience is the fundamental contention of environmental justice research and environmental racism studies which examine unequal and unjust distributions of pollution and toxicity in socially marginalized communities. Immigrants, the poor, women, indigenous peoples, and non-white communities, disproportionality inhabit polluted fenceline locations.<sup>1</sup> This dissertation examines three case studies of sociotechnical systems and risk in divergent fenceline communities: Black Mesa Arizona, the New River Valley of Virginia, and Camp Minden in Northern Louisiana.<sup>2</sup>

These three locations contain a large scale sociotechnical artifact interacting with the socioenvironment.<sup>3</sup> Each facility and their fenceline community interactions produce risk within the environment for humans living around the industrial operation. The coal slurry pipeline on the Navajo Nation began its journey at the Black Mesa Mine just yards from families who reside next to operations. The Radford Army Ammunition Plant is surrounded by many people at the intersection of Montgomery, Pulaski, and Giles Counties in Southwest Virginia. Finally, the Louisiana Army Ammunition Plant's improperly stored M6 explosive disposal controversy proposed open burning next to the communities of Minden in Webster Parish. Through an analysis of these three socioenvironmental and sociotechnical controversies, this dissertation provides insight into how divergent discourses, knowledge, and expertise challenge scholar-activists who

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1 David Schlosberg, *Defining Environmental Justice: Theories, Movements, and Nature* (Oxford;New York;: Oxford University Press, 2007).

2 The use of the term 'Fenceline' originates from Steve Lerner in *Sacrifice Zones, The Frontlines of Toxic Exposure in the United States*. Steve Lerner, *Sacrifice Zones : The Front Lines of Toxic Chemical Exposure in the United States* (Cambridge, Mass.: MIT Press, 2010).

3 Deploying the terms 'sociotechnical' and 'socioenvironment' conveys the 'the shaping and shaped by' thesis of Thomas Hughes, in conjunction to theoretical developments in conceptualizing relationships between the environment and human society in the Anthropocene. Human activities are impacting the planet in ways which we do not fully understand through science. Technologies shape and are shaped by society. Through human activity the environment is being shaped and is in turn shaping the society. This reciprocal argument in the Anthropocene understands that the environment has agency on society and shapes and is shaped by technoscientific activities. This is a development previewed in the work of theorists of Actor Network Theory like Michel Callon who have argued that scallops have agencies on farmers. See: Thomas Hughes in Merritt Roe Smith and Leo Marx, *Does Technology Drive History? : The Dilemma of Technological Determinism* (Cambridge, Mass: MIT Press, 1994)., Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St Brieuc Bay," *The Sociological Review* 32 (1984).

orient toward research agendas at the nexus of public participation, citizens' science, fenceline knowledge, expertise, and risk.

This research inspects knowledge and expertise on the fenceline to situate the construction of risk in proximity to polluting techniques by mobilizing the concept of the fenceline. The notion of the fenceline fundamentally underpins arguments about environmental inequality illustrated by over 20 years of environmental justice research.<sup>4</sup> Fenceline areas are risky, dangerous, and uncertain spaces. Fencelines exist as a contested spaces. For example, in 1987 the *Commission for Racial Justice's* report "Toxic Wastes and Race in the United States" examines the location of hazardous waste sites and race. The report presents:

...findings from two cross-sectional studies on demographic patterns associated with (1) commercial hazardous waste facilities and (2) uncontrolled toxic waste sites. The first was an analytical study which revealed a striking relationship between the location of commercial hazardous waste facilities and race. The second was a descriptive study which documented the widespread presence of uncontrolled toxic waste sites in racial and ethnic communities throughout the United States.<sup>5</sup>

Environmental justice research has consistently shown that environmental racism and inequality are created by the colocation of facilities and marginalized groups of people.<sup>6</sup> Environmental justice scholarship chronicles the relationships between disenfranchised peoples and polluting industry.<sup>7</sup> Great inequalities and contestations of exposure, toxicity, risk, expertise, and knowledge exist in fenceline locations.

Further nuance in recent research situates the notion of the 'sacrifice zone' as contested spaces within the territory of nation-states where mining, extraction, and risky production take place.<sup>8</sup> For example, one of the most researched and documented cases of national sacrifice is the Nevada Test Site. Nuclear weapons were detonated upwind from homes, spreading radiation across the continent, sickening people, plants, and animals. The Western Shoshone is the most nuclear bombed nation on earth. *The Advisory Committee on Human Radiation Experiments, Final Report*, explains:

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4 M. Egan, "Subaltern Environmentalism in the United States: A Historiographic Review," *Environment and History* 8, no. 1 (2002).

5 Benjamin F. Chavis and Charles Lee, "Toxic Waste and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites," (Commission for Racial Justice. United Church of Christ, 1987).

6 See: Julian McCaull, "Discriminatory Air Pollution," (1976)., Robert D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality*, vol. 3rd (Boulder, Colo: Westview Press, 2000)., Brian J. L. Berry and Susan Caris, *The Social Burdens of Environmental Pollution: A Comparative Metropolitan Data Source* (Cambridge, Mass: Ballinger Pub. Co, 1977)., R.D. Bullard, D.A. Alston, and Panos Institute, *We Speak for Ourselves: Social Justice, Race, and Environment* (Panos Institute, 1990).

7 Daniel C. Wigley and Kristin S. Shrader-Frechette, "Environmental Racism and Biased Methods of Risk Assessment," *Risk* (Concord, N.H.) 7, no. 1. Lyndsy Rutherford, "Redressing U.S. Corporate Environmental Harms Abroad through Transnational Public Law Litigation: Generating a Global Discourse on the International Definition of Environmental Justice," *Georgetown International Environmental Law Review* 14, no. 4 (2002). Schlosberg.

8 Lerner., Drew Cottle, "Land, Life and Labour in the Sacrifice Zone: The Socio-Economic Dynamics of Open-Cut Coal Mining in the Upper Hunter Valley, New South Wales," *Rural Society* (2013). For an analysis of the construction of nation-states see: Benedict R. O'G Anderson, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, vol. Rev. (New York;London;: Verso, 2006).

Under some circumstances, however, the federal government may invoke exceptions to these baseline standards—imposing greater risks on its citizens where national need dictates. Under the Clean Air Act, only the president may invoke such exceptions, and only on the basis of ‘national security interest.’ Under the Atomic Energy Act, however, the Department of Energy is largely exempt from external regulation. When its predecessor, the Atomic Energy Commission, developed regulations for civilian nuclear power industry, it also committed to operate its own nuclear facilities according to certain safety provisions, but allowed itself an exemption ‘when over-riding nation security considerations dictate’ Such an exception under the Atomic Energy Act could still be invoked today. These exemptions clearly allow national security interests to take precedence over public health concerns.<sup>9</sup>

Sacrifice zones are locations where the environment and people are surrendered for the pursuit of production, national-security, and knowledge from the construction and implementation of risky technoscientific activities. Sacrifice zones create long-term consequences for the communities in which risky activities are conducted. Sacrifice zones exist as locations where a place is ruined through the incursion and activities of large polluting and disruptive industry.<sup>10</sup>

Environmental justice research is concerned with conceptualizing and investigating the sacrifice of people and place from risky industrial activities in order to normatively pursue justice within these spaces. Industrial facilities enframe residents’ experience of a place by altering place, imposing negative consequences to the environment and humans, in turn laboratorizing the location through the creation of known and unknown consequences of risk within the community.<sup>11</sup> Environmental justice research consistently examines how location next to largescale industrial facilities force fenceline residents to experience confront challenges unlike those who live far away from the fenceline.<sup>12</sup>

The position of a polluting facility next to a community not only embeds social and environmental inequalities through the physical location of humans and non-humans on the fenceline, but also epistemic inequalities. Facility experts produce knowledge inequality using definitive claims of risk in discursive assessments that attempt to quantify the risk to the lives of fenceline residents and the environment. Oftentimes these official risk assessments are incomplete because they cannot account for unknown consequences, accidents, and evolving knowledge over time about the effects of sociotechnical production. Most flounder to include fenceline knowledge and expertise of the daily experience of risk from living within contested fenceline spaces.

Excluding the standpoint of fenceline experience, official risk assessments fail to operationalize the crucial insights of fenceline knowledge and expertise. Risks assessments suffer

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9 United States. Advisory Committee on Human Radiation Experiments, "Advisory Committee on Human Radiation Experiments: Final Report," (Washington, D.C Government Printing Office, 1995), 541.

10 Christopher Hayes McLeod and Films Bullfrog, *The Four Corners, a National Sacrifice Area?* Switkes, Glenn (Oley, PA: Bullfrog Films, 1984); Julia Fox, "Mountaintop Removal in West Virginia: An Environmental Sacrifice Zone," *Organization & Environment* 12, no. 2 (1999).

11 Polluting industries co-construct communities helping residents economically by providing work where otherwise there would little economic opportunity. The standing reserve of productivity is only part of the story of what industry location does to a community as the benefits of an industry are not uniform or hegemonic. See: Sheila Jasanoff, *States of Knowledge: The Co-Production of Science and Social Order* (Taylor & Francis Group, 2004). Martin Heidegger, *The Question Concerning Technology, and Other Essays*, 1st ed. (New York: Harper & Row, 1977).

12 Egan.

from inadequate inclusion of fenceline perspectives. The exclusion of fenceline knowledge and expertise underpins a weak objectivity of risk found in official risk assessments. Unequal risk adjudications create epistemic inequalities that are coproduced from within the physical location of communities next to a toxic, hazardous facilities. The production of an apparent objective discourse of risk by regulatory and producer experts perpetuates epistemic inequality by marginalizing fenceline perspectives. I argue that risk cannot be objectively assessed without including the study of the standpoint of the daily experience of risk by those that inhabit in closest proximity to the fenceline. Inequality on the fenceline can be reduced by the including fenceline knowledge and expertise.

The three cases of this dissertation concern how fenceline communities face knowledge claims from expert regulators and profit generators who use risk discourse to dispel community narratives and understandings of risk. Regulators and producers mobilize uncertainty by claiming that fenceline residents lack the appropriate knowledge and expertise to understand risk. They construct a definitive account of risk and toxicity in context to the lives of fenceline residents, claiming that fenceline experience and knowledge lacks definition and clarity. Official risk assessments mobilize reduced objectivity, creating distortions in the accounting of the experience and conditions on the fenceline in official discourse.

Sandra Harding's *Whose Science? Whose Knowledge?*, details the case for the development of a feminist standpoint epistemology to increase objectivity in the conduct of research. She defines weak objectivity:

...as a contradictory notion, and its contradictory character is largely responsible for its usefulness and its widespread appeal to dominant groups. It offers hope that scientists and science institutions, themselves, admittedly historically located, can produce claims that will be regarded as objectively valid without their having to examine critically their own historical commitments, from which---intentionally or not----they actively construct their scientific research.<sup>13</sup>

Harding argues for a “strong objectivity.” She recognizes the important knowledge contributions that can be made from divergent standpoints including women and other marginalized groups within the conduct of research. Historically, knowledge producers are representative of the many groups and perspectives of society. Scientific research has overwhelmingly been conducted by western-white-male privileged individuals exerting a near monopoly on within the institutions of knowledge production. Harding argues, that by ignoring differences between the masculine and feminine personality structures value-free neutral positions of weak objectivity “...deteriorates objectivity to devalue or ignore what can be learned by starting research from the perspective provided by women’s personality structures.”<sup>14</sup> In contrast, Harding argues that objectivity can be strengthened when research is reflexively aware of its social situatedness. Harding asserts “In a socially stratified society the objectivity of the results of research is increased by political activism by and on behalf of oppressed, exploited, and dominated groups.”<sup>15</sup> Harding articulates that the

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13 Sandra G. Harding, *Whose Science? Whose Knowledge?: Thinking from Women's Lives* (Ithaca, N.Y: Cornell University Press, 1991), 147.

14 *Ibid.*, 121-22.

15 *Ibid.*, 127.

notion of value-free objectivism produces less objective and more distorted results in the conduct of research. Critiquing weak objectivity she argues:

Objectivists claim that objectivity requires the elimination of *all* social values and interests from the research process and the results of research. It is clear, however, that not all social values and interests have the same bad effects upon the results of research. Some have systematically generated less partial and distorted beliefs than others---or than purportedly value-free research---as earlier chapter have argued.<sup>16</sup>

Harding's crucial point is that weak objectivity cannot conceptualize the need for critically examining the fact that nature, as the object-of-human-knowledge, never comes to us purely, but is thoroughly constituted by social thought. She argues for "strong objectivity" that examines the cultural agendas and assumptions that are part of the background assumptions and auxiliary hypotheses of research practitioners. Harding states, "...we can think of strong objectivity as extending the notion of scientific research to include systematic examination of background beliefs."<sup>17</sup> Furthermore, "...a strong notion objectivity requires a commitment to acknowledge the historical character of every belief or set of beliefs---a commitment to cultural, sociological, historical relativism. But it also requires that judgmental or epistemological relativism be rejected."<sup>18</sup> Harding argues, through the inclusion of a feminist standpoint in research, objectivity is increased because of the greater resolution afforded to researchers who begin research with an interrogation of the historical marginalization of the perspectives of non-dominate groups within the conduct of research.

Harding's critical insights help frame the social situatedness of knowledge on the fenceline. At the fenceline, risk is assessed by privileged experts without a critical, more objective analysis of the perspectives, knowledge, expertise, and experience of people living with quotidian exposure to emissions, blasting, pollution, poverty, negative health and environmental effects conditions of an invasive industry. Strong objectivity is a particularly important concept for the increasing our understanding fenceline risk. Fenceline residents confront a weak objectivity of regulatory and production expert discourses of risk largely in part because of the lack of recognition of a socially situated understanding of the experience of risk within official risk discourse.

The exclusion of fenceline standpoint epistemology from official risk assessments and decision making processes, at the nexus of the operation of sociotechnical practices on the fenceline, produces the weak objectivity of the accounts of risk within industrial spaces. The exclusion of valuable local knowledge from risk assessment discourse reduces the clarity of the scientific and social understanding of risk by ignoring and deprivileging the accounts, knowledge, and experience of those who inhabit the fenceline.

This dissertation juxtaposes cases where powerful regulators and production experts describe risk without including fenceline expertise. Weak objectivity on fenceline risk does not include the valuable experience and knowledge that fenceline residents bring to the table from their knowledge of the local environment and risk situation confronted in daily life. The failure to include the standpoint of the fenceline residents into official risk discourse illustrates a further weakness in the claims of objectivity by officials' risk assessments. Harding recognizes that weak

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16 Ibid., 144.

17 Ibid., 149.

18 Ibid., 156.

objectivity serves to keep questions from being asked and research from being conducted. She states:

The notion of objectivity is useful because its meaning and history support such standards [how the world is and ought to be] Today, as in the past, there are powerful interests ranged against attempts to find out the regularities and underlying causal tendencies in the natural and social worlds. Some groups do not want exposed to public scrutiny the effect on the environment of agribusiness or of pesticide use in domestic gardening.<sup>19</sup>

Harding specifically mentions environmental issues as a critical site for where the concept of strong objectivity could impact powerful elements in society. Fencelines are crucial locations for examining the intersections between powerful regulators and producers, the environment, and local residents who confront the negative effects and risk of risky production.

Fenceline residents are in a prime place to construct our own knowledge and expertise of the effects and risk of a polluting facility. Fenceline residents face uncertainty. Their lived experience and knowledge is rarely factored into the permits issued by neoliberal regulators to legitimize polluting industry. Knowledge inequalities coproduce social inequality through the concentration of exposure, emissions, pollution, species die-off, resource depletion, and other negative impacts around risky industrial fencelines. Uncertainty about the experience and knowledge of risk is fundamental to life on the fenceline. Residents grapple with unknowns and lack of data in weak objective risk assessments and expert accounts that use claims of scientific authority and certainty to evaluate and assess risk on the fenceline.

Toxic uncertainty is central to the construction of epistemic inequality. Expert risk discourses sustain narratives of community members as uninformed and lacking the necessary knowledge to understand their “safety” as determined by official risk discourses. The spatial inequality of the fenceline is complemented by epistemological inequalities that are exploited by production and regulatory experts to sustain industrial pollution in fenceline communities. Through the construction of doubt of fenceline knowledge claims, experts privilege their own knowledge about safety and the proper adjudication of acceptable risk. The tools of expert risk analyses are discursive. Risk assessments, environmental impact statements, and permits legitimize industrial activities through their discursive formulations of safety, control, and management. In doing so these texts quantify risk for fenceline communities.

Further complementing regulatory and production knowledge is the deliberate production of secrecy and ignorance on the fenceline via suppression of discussion, refusal to implement monitoring, and deliberate censorship of data. These factors reduce objectivity on the fenceline and limit our understanding of the conditions that fenceline communities live with. The production of secrecy and ignorance are not merely limited to the lack of resources or time, but can be understood as a willful act of domination, inequality, and exploitation.<sup>20</sup>

For example, at the Radford Army Ammunition Plant, the Agency for Toxic Substances and Disease Control’s 2014 Health Consultation for the Radford Army Ammunition Plant concludes that no groundwater contamination is moving offsite even though little testing has been

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19 Ibid., 160.

20 See the excellent theorization of ignorance in context to risk by: S. Sullivan and N. Tuana, *Race and Epistemologies of Ignorance* (State University of New York Press, 2007).

conducted to verify these claims in fluid and dynamic karst hydrogeology.<sup>21</sup> The testing that has been conducted shows low-level-contamination in groundwater off site. For example, Virginia Tech found perchlorate and other contaminants in low levels in irrigation wells used at the Experimental Agricultural Station at Kentland Farm, but there is no further testing planned to determine the origin of the perchlorate, barium, dioxin, chromium, and furans.

In fenceline communities there is a discounting of fenceline knowledge and experience about the specific negative consequences associated with a given technoscientific activity.<sup>22</sup> Harding discusses the subjugated knowledge of marginalized communities within the conduct of scientific research.<sup>23</sup> I argue that fenceline community knowledge is subjugated by producer and regulator expert discourse which claims definitive epistemological superiority while not pursuing stronger objective accounts of fenceline conditions. Further testing could determine the origins of the contamination at Kentland Farm, yet it is not conducted. Residents confront emissions plumes and smells moving overhead, but they are told that it is safe, despite no air quality monitoring, and known open burning of hazardous waste.

Discounting local and fenceline knowledge is similar to indigenous colonial experiences of the subjugation of their culture's knowledge to the dominant culture's knowledge during moments of colonialism.<sup>24</sup> For example, in Black Mesa, Arizona, coal experts did not include knowledge claims that disturbing the coal would consequently disrupt water resources for local residents. Indigenous knowledge in Black Mesa claims that coal is the liver of the Earth and that disturbing it would alter a fragile balance of life in the desert environment. After 40 years, mining has significantly impacted and depleted water resources in Black Mesa as predicted by indigenous knowledge.

While local and indigenous knowledge claims differ, both face similar exclusions and hierarchies of evaluation by production and regulatory experts on the fenceline. Devaluing knowledge inhibits the contribution of people outside of the framework of regulatory and production expertise whether local or indigenous.<sup>25</sup> The Navajo (Diné) colonial experience shares

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21 Agency for Toxic Substances and Disease Registry, "Health Consultation: Evaluation of Potential for Chemicals to Groundwater or Surface Water to Affect Drinking Water in the Nearby Community: Radford Army Ammunition Plant," ed. U.S. Department of Health and Human Services (2015).

22 Barbara L. Allen, "Environmental Justice, Local Knowledge, and after-Disaster Planning in New Orleans," *Technology in Society* 29, no. 2 (2007). Jason Corburn, "Environmental Justice, Local Knowledge, and Risk: The Discourse of a Community-Based Cumulative Exposure Assessment," *Environmental Management* 29, no. 4 (2002).

23 Michel Foucault and Colin Gordon, *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977* (New York: Pantheon Books, 1980). Harding.

24 Helen Verran, "A Postcolonial Moment in Science Studies: Alternative Firing Regimes of Environmental Scientists and Aboriginal Landowners," *Social Studies of Science* 32, no. 5/6 (2002). While local knowledge and indigenous knowledge are different in the case of the Black Mesa fenceline their domains often overlap as residents are in a prime location to observe and understand the effects of an industrial activity in their communities.

25 Neoliberal ideology collapses the boundary between government regulator and production expert. Regulators facilitate production via permitting. Neoliberal ideology entails the ideology of state intervention to facilitate open markets. In self-regulatory regimes the expectation of government regulators is that producers have the most knowledge to ensure safe operation and should be trusted and allowed to regulate themselves with minimal state interference. For example, the nuclear industry after Three Mile Island disaster entered a period of self-regulation. See the work of Joseph V. Rees, *Hostages of Each Other: The Transformation of Nuclear Safety since Three Mile Island* (Chicago: University of Chicago Press, 1994).



many comparable themes to the experiences most fenceline communities experience when local knowledge is subjugated.

Indigenous groups and non-indigenous groups along fencelines face epistemological violence through expert risk calculations which often have the intended and unintended effect of devaluing the crucial claims of expert local knowledge and fenceline experience as less valid than production and regulatory expertise. The unequal power to define, assess, and determine risk for a fenceline community stems from production and regulatory institutional power to define and construct the reality of risk experience through institutionalized expert discourse.<sup>26</sup> Extraction and production processes are justified by the appeal to the “social good” of the activity even though beneficiaries are often far away from the fenceline of the activity. The discounting of fenceline knowledge, as legitimate, is crucial to the discursive power of the construction of risk on the fenceline by production and regulatory experts. The power to determine and assess knowledge of risk is crucial site of contestation for fenceline community members to understand their unique situation in context to large industrial polluters.

### ***Knowledge of the Fenceline:***

To give a glimpse into power of the processes of risk evaluation and assessment at stake on the fenceline, I adopt methodologies borrowing heavily from lived experiences on the United States’ largest Indian Reservation: The Navajo Nation. I spent many weeks on the reservation working as a paralegal researcher for an environmental justice attorney. We took public comments for the proposed United States Environmental Protection Agency rulemaking on Best Available Retrofit Technology (BART) for the Navajo Generating Station (NGS) near The Grand Canyon in Page, Arizona. Hearing the people, I logged thousands of miles within the region of Black Mesa, Tuba City, and Kayenta situated on the serene Colorado Plateau near the Four Corners of the Southwestern United States. This landscape is marred by uranium processing mills, hundreds of abandoned non-remediated uranium mines, water extraction wells, fracking sites, coal extraction, and fossil fueled power plants.

This experience was complemented by my birth in Appalachia. This region is known for being at the center of coal extraction through much of the United States’ industrial history. Growing up in the fenceline community of Price’s Fork near Radford Arsenal, in the Appalachian Mountains, near the abandoned Merrimac and McCoy coal mines, I knew of the devastating impacts of coal extraction in West Virginia caused by mountain top removal. Spending many years living within half a mile of fenceline of the Radford Arsenal, I experienced the fenceline. Together these experiences contributed valuable insight to this work and my development as a scholar-activist.

At a rally in front of Flagstaff City Hall on January 8, 2013 participants showed solidarity with the Idle No More Movement in Canada with the struggles on Black Mesa. I spoke at the rally discussing similarities between Appalachia and Black Mesa. Both regions are related through carbon extraction and power generation. Coal extraction relies on explosives and water use. Appalachia and Black Mesa have parallel struggles as each are coal extraction zones facing serious

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26 See: Pierre Bourdieu and Angela Znaniecki-Karp, "Structuralism and Theory of Sociological Knowledge," *Social Research* 35, no. 4 (1968)., Pierre Bourdieu, "Les Rites Comme Actes D'institution," *Actes de la Recherche en Science Sociales* 43 (1982)., Linda Tuhiwai Smith, *Decolonizing Methodologies: Research and Indigenous Peoples*, Second Edition ed. (Zed Books, 2012).

environmental and social issues. The dominant narrative linking these two disparate places is the history of colonial expansion of the United States. Connecting the east's coal extraction fencelines to those on Black Mesa is the colonial narrative of a vastly successful genocide of indigenous people and ecocidal coal policies that spread colonialism's manifest destiny westward across North America from Appalachia to Black Mesa.

Further complementing the relationship between Black Mesa and Appalachia is the ubiquitous use of explosives within the mining industry. The New River Valley's explosives manufacturing facility produces similar substances used to blast the earth to open coal seams. Explosives are produced and manufactured at facilities like the Radford Army Ammunition Plant. For example, at Camp Minden, Explo Systems Inc. took charge of waste military explosives, sending them to the coal fields of West Virginia for repurposed use. This abandoned material created the conditions for the largest proposed chemical open burn in the history the United States. Explo's waste military explosives were worthless due downturns in the coal market that began after the 2008 global financial crisis. The coal industry's collapse influenced the conditions leading to the bankruptcy and criminal charges filed against Explo Inc. for improperly storing explosive material at Camp Minden.

Together the three cases examine the ways in which knowledge on the fenceline intersects with regulatory and productions experts.<sup>27</sup> Working inside an indigenous extraction fenceline, illustrated stark differences between spaces like Black Mesa and Radford Arsenal by juxtaposing how knowledge is constructed and deployed. The rawness and routineness of the reservation knowledge clashes opened questions into how locations devoid of indigenous knowledge, like the Radford Arsenal, have divergent, yet similar, contestations over the environmental politics of knowledge and risk.

The largely white rural Virginia fenceline of Radford Arsenal is not a place most people identify as center of environmental degradation, yet this area bears the toxic legacy and continuing emissions from the largest polluter in the State of Virginia over the past 13 years.<sup>28</sup> Southwest Virginia's Radford fenceline contrasts sharply with the Navajo indigenous space where opposing knowledge claims confront each other through cultural differences, continuing oppression, and genocide of manifest destiny's forced indigenous relocation and confinement to reservations.

As a researcher I never encountered environmental claims that existed outside of the framework of western epistemology of environmental science in Southwest Virginia. Legal research at the Black Mesa extraction zone was crucial to familiarizing myself with divergent ways of knowing the socioenvironment. The experiences of hearing and seeing what it means to live within an extraction zone in a reservation space were invaluable. The contrasts between Black Mesa and the New River Valley helps to frame a general interrogation of risk in fenceline communities.

Throughout my work as a paralegal working for an attorney representing "illegal" Diné families in the Northeast Arizona at the Black Mesa mining complex in litigation against Peabody

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27 The bifurcation between fenceline and regulatory and production experts helps to examine categories of knowledge that originate from different places depending on where one is located. There is considerable diversity on fencelines and interactions with regulators and producers.

28 United States Environmental Protection Agency, "Toxics Release Inventory Program," <https://www.epa.gov/toxics-release-inventory-tri-program>.

Coal Company; I began to question the hierarchy of knowledge that was crucial to many of the stories we listened to throughout our work. Elders and activists frequently framed conversations about coal as the liver of the Earth. They mobilized accounts of their experience of risk by discussing the disappearance of medicinal plants, ammonium nitrate spills killing sheep, and the black-lungs on found on freshly buttered sheep within the mining area. They told stories of risk and the negative alteration of their socioenvironment through extraction.

Coal is generally 60 to 80% carbon depending on type, place of extraction, and quality. The interaction between carbon and water in the desert landscape is fundamental to life. Coal filters and purifies water in a landscape that contains significant amount of uranium and arsenic.<sup>29</sup> Residents emphasized the differences between their natural knowledge and Peabody's.

Coal as the liver of the Earth, is one example of differing knowledge claims about a black substance. In the West coal is constructed as an industrial fuel or the element of carbon that can be oxidized for energy or used for steel production. Coal is generally 60 to 80% carbon depending on type, place of extraction, and quality. The interaction between carbon and water in the desert landscape is fundamental to life. Coal filters and purifies water in a landscape that contains significant amount of uranium and arsenic.<sup>30</sup> Residents emphasized the differences between their natural knowledge and Peabody's.

The sacred landscape of Dinétah abounds with conceptualizations about the relationship between plants, animals, water, soil, minerals, and human experiences that contrast sharply with the way people understand their environment in the New River Valley. Reconciling knowledge claims that coal is the liver of the Earth, with my own experience from the coal country of Southwest Virginia, helped frame my synthesis of the diverse scholar-activist methodology used in this research. Assorted experiences on the reservation contribute to framing the contestations over knowledge, risk, justice, and expertise on the fenceline. Observations on the Black Mesa's fenceline translated into inquiry beyond the reservation to the issues of explosives production waste at Radford Army Ammunition Plant and disposal at Camp Minden; formerly the Louisiana Army Ammunition Plant.

### ***Scholar-Activist Methodology: Reflexive Representation and Normative Commitments:***

I employ a diversity in methods using what Javier Auyero and Débora Alejandra Swistun in *Flammable* call a Dadaist approach.<sup>31</sup> *Flammable* is an ethnographic account analyzing the power relations between residents and outsiders at the center of socially and politically produced meanings of contamination at a large petrochemical compound in Buenos Aires, Argentina. *Flammable* documents silent habituation to contamination and the almost complete absence of mass protest against daily toxic onslaught within a risky fenceline site.<sup>32</sup>

Dadaism is the anarchic art movement that emerged during the World War One. The term is associated with a rejection movement in the arts of nationalistic and bourgeois culture. Dadaists

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29 Leslie Macmillan, "Uranium Mines Dot Navajo Land, Neglected and Still Perilous," *The New York Times*, 2012/03/31/ 2012. "Uranium, Grazing Cattle, and Risks Unknown," *The New York Times*, <http://green.blogs.nytimes.com/2012/04/04/uranium-cattle-grazing-and-risks-unknown/>.

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31 Javier Auyero and Débora Alejandra Swistun, *Flammable: Environmental Suffering in an Argentine Shantytown* (Oxford, New York: Oxford University Press, 2009).

32 *Ibid.*, 4.

understood bourgeois and nationalist culture as the primary agent of war. Dadaists relied on methods of abstraction grounded in the portrayal of culture and technology as leading toward the organization of war, describing a corrupt modernity, lost to war and pointless industrial production.<sup>33</sup> They deployed cuttings and bits and pieces of parts to assemble their compositions in collages. Dadaistic art depicts industrial society melding into surrealist images of humanity in crisis. The silent habituation to injustice, of concern to Dadaists, mirrors a similar process of acclimatization to risk and toxicity that *Flammable* portrays.

Conditioning of fenceline communities to categorically accept contamination is a product of habituation to risk in context to power discourses of knowledge, and expertise. Auyero and Swistun observe that, “Collective perceptions of risk have rarely been scrutinized in specific sociospatial universes, such as *Flammable*, in which daily life is dominated by ignorance, errors, and doubts regarding sources and effects of toxicity and in which the minimization or denial of socially consequential actors is not a straightforward process.”<sup>34</sup> I analyze collective perceptions of risk by mobilizing a collage of discourses and methods from a variety of primary sources including risk assessments, newspaper articles, activist accounts, scientific and government reports. I utilize multiple fields of social inquiry to build an assemblage of representations that communicate three socio-environmental stories of risk on the fenceline.<sup>35</sup> Methods from sociology, philosophy, and history contribute to the innovative and interdisciplinary nature of the field of Science and Technology Studies. I ground this research in STS’s tradition of critical interdisciplinary inquiry that problematizes the relationships of technology, science, and society.<sup>36</sup>

Merging a fenceline scholar-activist account with my experiences within the colonial reservation system, I examine the construction of risk at the nexus of production and regulatory expertise and knowledge of sociotechnical activities. I synthesize elements from critical indigenous theory, environmental justice research, and STS’s interdisciplinary orientations to help frame arguments about the politics of knowledge of three cases at the intersection of risk, science, technology, and environmental justice.

I tell a story of fenceline risk from three unique perspectives: the legal researcher, the insider, and the outsider, offering a meta-analysis of crucial social issues within scholar-activist, qualitative research. Time spent at one of the Navajo Nation reservation’s extraction zones generated questions on how anthropological and sociological research has historically subjugated and oppressed indigenous knowledge on a hierarchy lower level than dominate western epistemology. The nakedness of the confrontation and distrust between experts, regulators, and fenceline community members is exposed raw within this reservation space due to years of

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33 "Hannah Höch | National Museum of Women in the Arts," National Museum of Women in the Arts, <http://www.nmwa.org/explore/artist-profiles/hannah-h%C3%B6ch>.

34 , 10.

35 Martha Craven Nussbaum, *Cultivating Humanity: A Classical Defense of Reform in Liberal Education* (Cambridge, Mass: Harvard University Press, 1997). Harding, Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (Basic Books, 1985). *Does Technology Drive History?: The Dilemma of Technological Determinism*, (Cambridge, Mass: MIT Press, 1994); Langdon Winner, "Do Artifacts Have Politics?," *Daedalus* 109, no. 1 (1980).

36 See the work of the Frankfurt School, in particular Herbert Marcuse. For a contemporary analysis see: Luis Suarez-Villa, *Technocapitalism: A Critical Perspective on Technological Innovation and Corporatism* (Philadelphia: Temple University Press, 2009).

colonialism. A brutal realism of oppression is reproduced within the extraction zone enframing the sacred land.<sup>37</sup>

A Dadaistic approach, as an assemblage of methods, entails the synthesis of experience, theory, and practice to actively pursue a normative critique. I adopt an approach that merges theory and practice to actively work toward a normative praxis of research that seeks to document how empowered fenceline knowledge and expertise can resist environmental injustice. I show how studying fenceline experience of risk suggests insights into how fenceline communities can empower themselves through the mobilization of their own expertise and knowledge.<sup>38</sup>

I stay true to Social Epistemology's Science and Technology Studies (STS) commitment to that examines how knowledge is socially situated, produced, diffused, and deployed through an analysis of power and social construction. The merging of critical indigenous theory's insights about the normative role of research with STS scholarship into how science and technology are socially situated activities frames the analysis. I argue that fenceline community members can organize knowledge and expertise to influence risk inequalities created by official discourses of production and regulatory experts within fenceline sites.<sup>39</sup> The Camp Minden Dialogue shows how when enrolled into decision making processes, fenceline residents can minimize their risk.

Methodological insights derived from critical indigenous theory and Social Epistemology are synthesized to examine three cases concerning knowledge and risk on the fenceline by prioritizing the expertise and knowledge contributions that fenceline residents bring to the table.<sup>40</sup> This approach is within the program of research at the center of indigeneity, colonialism, and environmental justice. Its trajectory traces its intellectual history to critical research of STS examined by the Frankfurt School.<sup>41</sup>

Prioritizing normative outcomes through the conduct of research, I seek to activate a reflexive analysis of the social issues of research in context to environmental justice in order to bolster STS research of subjugated fenceline knowledge by putting theory to practice. Across the three cases, I show how public participation and citizen science can intervene in a sociotechnical controversy to achieve results favorable for fenceline residents.

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37 See the work of Heidegger. Heidegger examines how technology like dams and bridges are set into the landscapes altering them and enframing nature within a framework of instrumental relationships of technology and society that are ordered for standing-reserve. While there is considerable contemporary work on how technologies mediate human experiences as hybrids, helping to shape and are shaped by society, large scale industrial technologies regardless of their constructivist allure, pollute, risk and negatively impact the socio-environment nearby by fundamentally changing the meaning of place. Industrial facilities irreparably change the spectrum of potential interactions between humans and the environment.

38 Auyero and Swistun.

39 The Handbook of Science and Technology Studies, ed. Edward J. Hackett, et al., third edition ed. (The MIT Press, 2007). Verran.

40 This is not to say that fenceline residents are not wrong or that their understandings and knowledge is not subject to error, but that power relations inherent within a polluting space overwhelmingly discount valuable knowledge claims of residents who are most likely to be most affected by large scale industrial operations.

41 Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance*, Cornell Studies in Comparative History (Ithaca: Cornell University Press, 1989). Herbert Marcuse and Herbert Marcuse, *Technology, War, and Fascism* (London: Routledge, 1998); Herbert Marcuse, *One-Dimensional Man Studies in the Ideology of Advanced Industrial Society* (Boston: Beacon Press, 1964).

I do not concern myself with either realist or constructionist debates found in Science and Technology Studies, nor do I pretend that such issues should take up the time of scholarship in a planet in the era of the Anthropocene where differentiating between the natural and artificial becomes increasingly difficult.<sup>42</sup> My concern is to document and account for subjugated knowledge by examining how people suffer from inequalities produced through sociotechnical systems. I show how weak objective, value-natural, epistemological status granted to traditional experts is inadequate to the understanding of risk when fenceline knowledge and expertise are excluded. I contend that to better understand risk, researchers and policy makers should draw on the unique accounts, experience, knowledge and expertise on the fenceline. I show how valuable fenceline knowledge and expertise are to understanding risk by telling a story of how the people most confronted by risk have valuable contributions to make. Fenceline perspectives strengthen our objective understanding of risk created by complex sociotechnical systems.

I ascribe normative commitments to research as storytelling and information sharing to illustrate how accounts of micro-level contestations of risk can aid macro-level discussions over assessment and presentation of risk confronted by other fenceline communities. This project understands that STS research and knowledge creation are themselves a political and social process. Researching fenceline risk is a process of knowledge construction, subject to knowledge politics, intersecting stakeholder perceptions, scientific facts, technological possibilities, and unknowns and inadequacy of existing information. I communicate a story of environmental risk through an analysis that utilizes a scholar-activist autoethnographic perspective.

Environmental scholar-activist research in the Anthropocene requires rethinking the role of expertise to include the expert knowledge contributions of those living on the frontlines of climate change, pollution, mining, and other risky facilities. Steven Epstein's work in "The Construction of Lay Expertise: AIDS Activism and the Forging of Credibility in the Reform of Clinical Trials," demonstrates potential avenues for activist intervention by activist-experts.<sup>43</sup> Fenceline activists have considerable power to become experts and influence the discourse of risk, drawing on their proximity to risk from fenceline experience. No better evidence of this is the work of those concerned citizens who succeeded in resisting the implementation of open burning of M6 propellant at Camp Minden. Their struggles for alternatives to open burning increased possibilities and enabled greater objective resolution of our understanding and knowledge of the dangers inherent the practice of open burning far beyond the local community. Other fenceline communities, confronting the toxic practice of open burning, continue to benefit from the fenceline knowledge constructed at Minden, which propelled a series of alternative technologies to public consciousness.

I argue that fenceline communities can self-empower by developing their own knowledge and expertise. Including fenceline standpoints increases objectivity of the risky situation on the fenceline. The struggles challenging indigenous cultures for knowledge equality and parity, discussed by critical indigenous theorists like Linda Smith, theoretically frames my analysis of subjugated knowledge at fenceline sites. Smith's research documents subjugated knowledge regimes within indigenous spaces. Issues of access, credibility, and diffusion of knowledge on the

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42 Louis J. Kotzé, "Rethinking Global Environmental Law and Governance in the Anthropocene," *Journal of Energy & Natural Resources Law* 32, no. 2 (2014).

43 Steven Epstein, "The Construction of Lay Expertise: Aids Activism and the Forging of Credibility in the Reform of Clinical Trials," *Science, Technology, & Human Values* 20, no. 4 (1995).

fenceline are similar to the processes of knowledge politics that exist within contested indigenous spaces. Indigenous perspectives about the experience of subjugated knowledge regimes provides critical insight into similar conditions on the fenceline. Knowledge inequalities created by production and regulatory expertise, at the nexus of controversies over the power politics of knowledge and risk, requires an examination of the social situatedness of risk, knowledge, and expertise. This dissertation illustrates how comparable processes of knowledge exclusion and inequality that indigenous people face is often parallel to that of fenceline communities.

***Standpoint Theory: Feminist and Critical Indigenous Theory Applied to Risk:***

To grapple with methodological concerns, the account deployed over the three cases varies substantially as a result of the location of the researcher to the case and social, technical, and scientific interactions afforded to him in the conduct of this research. One of the major assumptions informing this work is that communication can help to foster debate and provide better insights to reduce risk.<sup>44</sup> Communication and interrogation of risk is the norm that is elevated in all three accounts of each specific case.<sup>45</sup> Communicating risk from the standpoint of the fenceline enables greater resolution of objectivity of the social, technical, and scientific experience of risk on the fenceline by building solidarity and sharing across divergent fenceline sites. In doing so, I push back on the notion of a single expertise within fenceline sites.

The normative commitment to interrogate the politics of risk and knowledge within the fenceline originates in distrust scholars face when engaged in fenceline landscapes; particularly indigenous spaces. For example, in my time spent among on the Navajo Nation many people spoke of a general dissatisfaction with status quo academics likening them to false prophets of the coal mining company, government, and other experts that come and go with a revolving door like circulation, doing nothing to ameliorate the situation. Many residents seriously doubted the role of lawyers, academics, or any other outsider to improve fenceline conditions. Debora Alejandra Swistun and Javier Auyero recount similar feelings amongst the people they worked with in *Flammable*.<sup>46</sup>

A body of indigenous scholarship argues that "...research has been a process that exploits indigenous peoples, their culture, their knowledge and their resources."<sup>47</sup> As a paralegal many people I spoke to recalled fatalistic feelings of helplessness about what researchers, lawyers, and outsiders can do through their presence and intervention. Often outsiders promised success and failed in the end to deliver any substantive change for people living in the fallout of ongoing resource colony projects.

Such questions forced me to think about how to strive for a research normative model that works for environmental justice while simultaneously pursuing a normative commitment to communicate shared experiences on the fenceline in order to enhance our understanding through greater objectivity of the fenceline experience. This dissertation is an exercise in communication of conditions on the fenceline to those who are unaware of the stories of environmental suffering in distant places. Communication and storytelling promote solidarity and knowledge sharing.

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44 Verity Jones, "Communicating Environmental Knowledges: Young People and the Risk Society," *Social & Cultural Geography* 5, no. 2 (2004). The Camp Minden Dialogue's ability to

45 D. D. Kumar, "Science for Democracy - Communicating Science for Knowledge Equity," *BULLETIN OF SCIENCE TECHNOLOGY & SOCIETY* 10, no. 5-6 (1990).

46 Auyero and Swistun.

47 Smith xi

Dialogue and information sharing across fenceline communities is important. The normative commitment of the role of scholarship as a sharing of information is evident throughout the three cases surveyed.

Prioritizing the norm of sharing and diffusion of stories to create stronger objective accounts by including the fenceline standpoint, is a necessary reaction to critiques of academic research by indigenous and feminist scholars. Indigenous scholarship catalogues many cases of great abuse and suffering at the hands of epistemological claims of value-natural, weak objective truth oriented research as the only fundamental or “real” knowledge.<sup>48</sup>

I identify with a research practice that is less hostile to subjugated cultures by championing the operationalization of their standpoints to achieve a stronger more resolute objectivity. I bring critical insights into my own research in Black Mesa, Radford and Camp Minden. My praxis adopts normative commitments that prioritize community empowerment using research to give voice to the unseen, the taken-for-granted, to make visible the invisibility of the standpoints of local and subjugated knowledge.<sup>49</sup> I borrow heavily from the approach of Linda Smith in *Decolonizing Methodologies*. In her seminal work on the social issues of research and indigenous people she articulates:

One connection that I made in the book was between the indigenous agenda of self-determination, indigenous rights and sovereignty, on the one hand, and, on the other, a complementary indigenous research agenda that was about building capacity and working towards healing, reconciliation and development...Systematic change requires capability, leadership, support, time, courage, reflexivity, determination and compassion. It is hard work and the outcome often seems a distant vision. Paulo Friere referred to this as praxis; theory, action and reflection; Graham Smith has called it indigenous transforming praxis.<sup>50</sup>

Like Smith, “I understood research as a set of ideas, practices, and privileges that were embedded in imperial expansionism and colonization and institutionalized in academic disciplines, schools, curricula, universities, and power.”<sup>51</sup> Historically, western epistemology denies local, feminist, and indigenous knowledge equal epistemological status or relevance. Epistemological injustice produces suffering and social inequality for those whose standpoints are excluded. Sandra Harding, Donna Haraway, and Linda Smith discuss social and epistemological inequality at great length.<sup>52</sup>

My understanding of the social issues of qualitative research owes considerable debt to Smith’s innovative methodological approaches in her examination of research methodologies and indigenous communities. Her critical indigenous research critique is useful to fenceline researchers because of the similar dynamics of discounting of perspectives, experiences, and knowledge of the fenceline. The synthesis of critical indigenous theory with environmental justice scholarship is important new terrain in the Anthropocene, where boundaries between natural, artificial;

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48 James Maffie, “In the End, We Have the Gatling Gun, and They Have Not’: Future Prospects of Indigenous Knowledges,” *Futures* 41, no. 1 (2009).

49 James C. Scott, *Decoding Subaltern Politics: Ideology, Disguise, and Resistance in Agrarian Politics*, vol. 8 (Abingdon, Oxon; New York, NY: Routledge, 2013).

50 Smith, xiii.

51 Smith, x.

52 Harding; Donna Jeanne Haraway, *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991).



adulterated and unadulterated; polluted and pristine; are increasingly blurred through the ubiquity and omnipresence of human agency delivered by the power of sociotechnical systems.

For example, Smith states, “The notion of research as an objective, value-free and scientific process for observing and making sense of human realities is taken granted by many social scientists. Philosophers of science refer to this attitude as ‘positivism.’”<sup>53</sup> Positivism, as realist theory of scientific inquiry, posits the natural world as a universe ‘out there’ which is capable of being understood and known through the application of logic and reason.

Scholar-activist research aims to shape the world around us through a conscious recognition of the interplay between knowledge, politics, science, and technology rather than positing a world ‘out there’ disconnected from human agency. Scholar-activist research begins with an understanding of the political implications of research as subjective and value-laden from its conception.

For example, the positivist James Maffie, discusses in, *In the end, we have the Gatling gun, and they have not: Future prospects of indigenous knowledge*, “Reality is characterized by being, not becoming. That which is permanent, static, and timeless is real: that which is impermanent, mutable, and time is not. Laws, structure, and essences do not change and are ontologically fundamentally. All is ontologically derivative and reducible to them.”<sup>54</sup> This argument is fundamentally Platonic and adopts a theory of forms whereby one can discover the essence of all phenomena to establish the truth of the object or process.<sup>55</sup>

According to positivist logic there is only one true description of a phenomena. Weak objectivity claims there is only one description of phenomena, yet ignores the multiple social perspectives that must be included in order to approach a normative commitment to adequate description. Weak objectivity provides the rhetorical point of departure to minimize the self; attempting to eliminate the human from the verified results of positivist inquiry. Objectivism results in the trap of abstraction cutting off one’s critical awareness of place and location in society. Such a theory precludes the fundamental contribution of a citizen science and fenceline expertise by reducing expertise to a singular location. In a weak objectivist world, phenomena cannot mean different things to different people, the social situatedness of observation and experience is denied.

Concretely, we observe that coal mining executives experience mining differently than the family who is relocated to make way for the dragline excavator, hence the importance of standpoint epistemologies to strengthen objectivity. To strengthen our objectivity of fenceline risk, I offer a praxis of research that recognizes the activist history of STS as a project aimed at critiquing risk discourse created through the human endeavors of science and technology organized in large-scale disruptive systems.<sup>56</sup> I interrogate the premises of scientific and technological progress by examining how fenceline communities resist the simplicity of the expert/lay divide. I show how fenceline knowledge can inform the discursive construction of risk. Similar to Epstein’s observations with AIDS activists, I argue expert-activists can become experts on the risks from

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53 Smith, 166.

54 Maffie, 56.

55 Ibid.

56 See the works of Charles Perrow, *Normal Accidents: Living with High-Risk Technologies*, Updated ed. (Princeton University Press, 1999). Marcuse. Herbert Marcuse and Douglas Kellner, *Technology, War, and Fascism*, vol. 1 (New York;London;: Routledge, 1998); Jacques Ellul, *The Technological Society*, 1st American ed. ed. (New York: Knopf, 1964).

production processes they experience through inhabitation of the vulnerable and risky space of the fenceline.

Production and regulatory experts normatively perpetuate the continuation of production through careful and calculated discursive construction of risk across generalizable and standardized categories. Risk assessments are presented in a positivist framework as value-free. Brian Wynne argues that differences between expert and lay knowledge reside in standardized scientific norms of control which reduce the hybridization of scientific-technical networks of the categories of human, natural, and artificial.<sup>57</sup> The presentation of value-free objective risk assessments, which exclude fenceline perspectives, discursively limits the experience of risk for fenceline residents to a framework of standards and generalized daily encounters with risk. Harding argues:

The conception of value-free, impartial, dispassionate research is supposed to direct the identification of all social values and their elimination from the results of research, yet it has been operationalized to identify and eliminate *only* those social values and interests that differ among researchers and critics who are regarded by the scientific community as competent to make judgements. If the community of ‘qualified’ researchers and critics systematically excludes, for example, all African Americans and women of all races, and if the larger culture is stratified by race and gender and lacks powerful critiques of this stratification, it is not possible to imagine that racist and sexist interests and values would be identified within a community of scientists composed entirely of people who benefit--intentionally or not--from institutional racism and sexism.<sup>58</sup>

Similarly, when risk assessments systematically exclude perspectives of fenceline communities that make up the assessed population, it is not possible for an objective risk assessment because those who claim the authority to adjudicate and assess risk benefit from the systematic exclusion of fenceline perspectives, experiences, knowledge and expertise.

Wynne in “May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide,” states, “I suggested above that a general reason for the possible divergence between expert and public knowledges about risks is that expert knowledge embodies social assumptions and models framing its objectivist language, and that lay people have legitimate claim to debate those assumptions.”<sup>59</sup> Wynne describes how experts assumed a specific type of soil type in their calculations of sheep contamination, failing to take into account the local knowledge of the sheep farmers and prevalence of unique environmental conditions in the assessments of risk and toxicity from radiocaesium. Wynne calls for the “...reexamination of received ideas of the nature of scientific and lay knowledges,” in order to stabilize human relationships without introducing alienation, exclusion, and inflexibility found in his case study of the interaction between experts and lay sheep farmers during the Chernobyl crisis.<sup>60</sup>

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57 Scott Lash, Bronislaw Szerszynski, and Brian Wynne, *Risk, Environment and Modernity : Towards a New Ecology, Theory, Culture & Society* (London ; Thousand Oaks, Calif.: Sage Publications, 1996), 71, 73.

58 Harding, 143.

59 Lash, Szerszynski, and Wynne, 59.

60 *Ibid.*, 73.

Steven Epstein argues that AIDS activists became critical actors in the creation of scientific knowledge.<sup>61</sup> Epstein states:

More profoundly, this case demonstrates that activist movements, through amassing different forms of credibility, can in certain circumstances become genuine participants in the construction of scientific knowledge- that they can (within definite limits) effect changes both in the epistemic practices of biomedical research and in the therapeutic techniques of medical care.<sup>62</sup>

This dissertation shows how fenceline scholar-activists can become critical actors in the construction of knowledge about risk on the fenceline. I argue that activist-experts can intervene on the fenceline to develop knowledge about risk through documentation of daily encounters with the conditions of fenceline experience.<sup>63</sup> Activist-experts enter can into discursive arenas to challenge the power of traditional experts who regulate and produce the narrative of safety on the fenceline. Fenceline expertise helps to mediate the contestations over the construction of risk on the fenceline.

To avoid debates over the status of expert vs lay knowledge, I rely on Collins and Evan's use of the term "experienced-based-experts" to frame the valuable experience and knowledge that fenceline experts bring to politics of risk.<sup>64</sup> Wynne, Evans, Collins, and Epstein offer conceptions of expertise which work beyond the simple bifurcation of experts/lay knowledge. Together their work illustrates the contestations over the term 'expert.' They show that there is a considerable need for further theorization and empirical work in context to the politics of knowledge, expertise, and risk on the fenceline. Fenceline knowledge is the category used to describe the knowledge of experience-based experts who contribute to understanding the vulnerable space of the fenceline in their daily encounters with risk.

Coal production is experienced differently depending on where a person or community is located within the production network. The experience of risk is influenced by social positions and subject to inequalities in the proximity to dangerous fencelines. Those that benefit from the production of electricity from coal live far away from the extraction on Black Mesa. Southern California residents experience the benefit of coal production much differently than the Diné living around extraction site.

Fundamentally risk assessments abstract fenceline experience and knowledge. Risk assessments reduce expertise to a calculation within the paradigm of the latest technique of risk determination that is generalizable and knowable.<sup>65</sup> What this approach ignores is the fundamental contentious social and political context in which risk is produced, constructed, and experienced in a dynamic and changing arena of knowledge evolution and fenceline experience. Greg Cajete argues:

The tragedy of modern society is that people fall into the trap of abstraction. The host of modern technologies that only mirror ourselves hypnotizes perception and attention.

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61 Epstein.

62 Ibid., 409.

63 Ibid., 414.

64 H. M. Collins and Robert Evans, "The Third Wave of Science Studies: Studies of Expertise and Experience," *Social Studies of Science* 32, no. 2 (2002): 238.

65 Ellul.

While our bodies have been turned to the sounds of birds and the changing qualities of natural environments, our socialization makes us oblivious to our natural sensibilities.<sup>66</sup>

Risk assessments abstract experience through standardization and homogenization of experience. Produced using the norms of objectivism, these assessments ignore fenceline knowledge and experience. “Objectivity is its own limitation”, according to Manulani Aluli Meyer.<sup>67</sup> Objectivity of a situation is experienced in multiple ways depending on one’s social location and knowledge over time. The mirroring and hypnotizing of our perception by modern technology blinds us from better understanding phenomena because we often experience knowledge as a definitive account of our world in a given time and space rendering us incapable of imagining alternatives.

Our loss of natural sensibilities can be recovered, but it is a difficult process which requires a transformation of consciousness. This transformation cannot occur so long we fail to recognize the harms of reduction and standardization through value-neutral abstraction. Claude Alvares argues in “Science, Colonialism and Violence: A Luddite View”, that abstraction reduces all experience to zero through a denial of the situatedness or history of the phenomena studied.<sup>68</sup> Cajete and Alvares articulate this process of reduction in context to the pursuit of an objectivity that ignores the social situatedness of knowledge and experience.

I argue that fenceline residents’ experience of risk is reduced to weak objective discursive statements constructed by risk experts. Risk assessments inform the issuance of a pollution permit by regulatory organizations who apply generalizable and standard models of risk analysis to unique local situations. Post-colonial scholarship is concerned with the reduction of experience into instrumental reason as a defining characteristic of western epistemology’s enlightenment project.<sup>69</sup> Abstraction of fenceline experience denies the lived experience of the experiment of risk that is fundamentally different for fenceline residents vis-à-vis those who are benefiting from a risky activity.

The consequences of abstraction produces a discursive weak objectivity that is experienced by fenceline community members who encounter daily risks through their inhabitation of the fenceline. The reality of fenceline experience is often incongruent to the discursive formulation of official risk assessments and discourses. Standardized risk assessments model experiences that do not account for the daily lived experience of fenceline residents.

Through the mobilization of fenceline knowledge, activist-experts have agency to mediate the construction of standardized risk assessments by pointing out inadequacies and the social situatedness of risk. Discursively, risk assessments can be challenged through the public comment period of many permit actions. However, administrative permit actions continue to privilege regulatory experts who have the final power to adjudicate whether a public concern constitutes a

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66 Donald Trent Jacobs, *Unlearning the Language of Conquest: Scholars Expose Anti-Indianism in America : Deceptions That Influence War and Peace, Civil Liberties, Public Education, Religion and Spirituality, Democratic Ideals, the Environment, Law, Literature, Film, and Happiness*, vol. 1st (Austin: University of Texas Press, 2006), 255.

67 Norman K. Denzin, Yvonna S. Lincoln, and Linda Tuhiwai Smith, *Handbook of Critical and Indigenous Methodologies* (Los Angeles: Sage, 2008), 237.

68 Claude Alvares, *Science, Development and Violence: The Revolt against Modernity* (Oxford University Press, 1994), 42.

69 Bill Ashcroft, Gareth Griffiths, and Helen Tiffin, *The Post-Colonial Studies Reader*, vol. 1 (New York;London:: Routledge, 1995).

valid knowledge contribution or not. The power of judgement of risk continues to reside with the regulatory expert, who must normatively support production, at the expense of fenceline expertise, knowledge, and experience.

Through improved communication tools, technical monitoring, empirical analysis, oral history, ethnography, and citizen science, environmental sociologists can strengthen objectivity of existing accounts of risk. Martha Nussbaum's work documents the importance of communication to strengthen our normative pursuit of freedom, education, and knowledge diffusion.<sup>70</sup> This work operates at the forefront of policy and research on the fenceline seeking to improve the objectivity or risk experience within the fenceline space. Shannon Bell argues "...that we as social scientists are frequently positioned in such a way that we could serve as links between the people we study and policymakers, providing an avenue for exposing the ways that neoliberal policies negatively affect the health, safety, and well-being of disenfranchised groups [sic]."<sup>71</sup> I mobilize innovations of action-based research, using research to bridge the gap between the fenceline and policy in neoliberal risk regimes. I describe and act as a communicator of socioenvironmental research to inform policy makers, researchers, and fenceline community members about three stories of environmental justice in context to neoliberal risk determinations. I strengthen the requirement to include fenceline perspectives to offer a potential route toward the pursuit of greater empowerment for fenceline communities.

Together the three cases examine violent and dangerous practices found in sociotechnical fenceline spaces. Blasting coal from Earth, the production of explosives, and their disposal in open burning inflicts damage and risk on humans and non-humans. Each space is linked through disruptive practices exerting violence.<sup>72</sup> Each case recounts a type of violence in the arrangement of the given sociotechnical system. Collectively each space shows the unique risk of harm for fenceline community members.

This work contributes to the ongoing discussion of how technoscientific infrastructure development shapes and is shaped by communities. I empirically show how the politics of knowledge of risk from technoscientific development produces inequalities through the exclusion and subjugation of expert knowledge of fenceline communities. These communities occupy a critical place, with unique insights into how to monitor, analyze, study, and track the risk they experience. Understanding fenceline perspectives broadens our objectivity of the experience with and assessment of risk.<sup>73</sup> Local knowledge and citizen-science evaluates risk differently than the knowledge claims of fenceline industry and neoliberal state regulators. I argue that by including the standpoint of fenceline knowledge and experience our objectivity of risk is strengthened, reducing epistemic inequalities.

The formalization, acceptance, and distribution of a body of knowledge of risk can take years to coalesce and stabilize, especially in regards to a particular sociotechnical activity that is controversial. Oftentimes the normative goal of providing jobs or economic benefits trumps other

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70 Nussbaum.

71 Shannon Elizabeth Bell, "Bridging Activism and the Academy: Exposing Environmental Injustices through the Feminist Ethnographic Method of Photovoice1," *Human Ecology Review* 21, no. 1 (2015).

72 For an analysis on reductionist technologies, science, and methods and violence see the work of Ashis Nandy, *Science, Hegemony and Violence : A Requiem for Modernity* (Tokyo Japan ;Delhi: United Nations University ;;Oxford University Press, 1988).

73 Arturo Escobar, *Encountering Development* (Princeton University Press, 1994).

knowledge claims about a dangerous activity, such as how a given activity also produces human and environmental harm.<sup>74</sup> If and when knowledge does formalize about risk from a technoscientific practice it is heavily mediated by the politics of knowledge.

The politics of knowledge of risk and uncertainty fuels the risk society in which unknowns abound. The politics of knowledge complicates the clarity of understanding risk because official experts have the institutional and discursive power to control scientific evaluation and diffusion of technical knowledge by refusing to study a risk situation. Officials often cherry-pick knowledge of risk and expertise when it suits particular normative goals like continued production, job creation, higher profits, or economic benefit. The 2016 Flint lead crisis is a famous example of officials manipulating data to cover up the risk of lead contamination.<sup>75</sup> Depending on their social location actors will mobilize discourses which justify their particular politics in context to the definition of risk.<sup>76</sup>

### ***Three Cases of Risk in Context to Scholar-Activism:***

Drawing on the mix-method scholar activist approach described in the previous sections, I examine three cases from the fenceline from three divergent researcher locations. Chapter Two, from the perspective of the legal researcher, examines the history of the Black Mesa coal slurry pipeline controversy. This pipeline crosses hundreds of miles of desert in the Southwestern United States. Defunct since 2005, the pipeline brought cheap electricity to the lives of many people while simultaneously depriving fenceline residents of water, environmental and cognitive sovereignty, and security. The unequal and unevenness of the slurry line's impact illustrates the social situatedness of risk from one's location to a sociotechnical artifact. The pipeline's greatest negative impact is felt at the extraction point for its products of coal and water on Black Mesa.

Black Mesa is located at higher elevation than the surrounding desert, making it cooler, wetter, and more hospitable to human life than the surrounding lower elevations of harsh desert climate. Likely stemming from the reprieve from the harsh conditions its elevation provides, the mesa is a holy site for indigenous inhabitants. Coal mining has impacted the area since the early 1960s depleting significant amounts of water, disrupting the unique balance between the flora and fauna of the arid landscape. Fenceline residents often lack running water and electricity while their land concurrently provides these resources to the large cities of the Southwest.

Contamination risk is elevated through active coal mining sites due to continuous coal fires, coal dust emissions, erosion, chemical spills, inadequate mine reclamation, and the location of nearby mega-sized, coal-fired power generating stations. The construction, use, and abandonment of the Black Mesa coal slurry pipeline embodies the outsourcing of risk. The pipeline is a political

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74 One of the most famous cases explored within STS is fenceline community risk and the politics of expert knowledge around the fenceline of the nuclear testing site known as the Nevada Test Site. See: Zenna Mae, Eugene Bridges, interview by Mary Palevsky, 6-12-04, 2004.

75 Monica Davey and Richard Pérez-Peña, "Flint Water Crisis Yields First Criminal Charges," The New York Times, <http://www.nytimes.com/2016/04/21/us/first-criminal-charges-are-filed-in-flint-water-crisis.html>.

76 See the controversy of Atomic Energy Commission Scientist, Dr. Harold Knapp, who served as the expert whistleblower on the risks of Strontium 90 and children's absorption of the radioactive isotope spread through atmospheric testing and milk consumption: Congress. House Committee on Interstate Foreign Commerce Subcommittee on Oversight Investigations United States, ""The Forgotten Guinea Pigs": A Report on Health Effects of Low-Level Radiation Sustained as a Result of the Nuclear Weapons Testing Program Conducted by the United States Government," (U.S. Government Printing Office, 1980). See also the work of Brian Wynne in Lash, Szerszynski, and Wynne.

artifact of extraction technology used to externalize the negative consequences of risk of coal production and power generation away from Southern California to the desert of the Colorado Plateau. Though defunct it continues to jeopardize fenceline resident's health and safety.

Many residents echoed claims that existing institutions had failed the people to minimize their risks and protect their way of life. In 2016 Black Mesa residents continue to face trespassing notices, livestock impoundments, and threats for occupying land that is at the center of an ongoing dispute between the Navajo Nation Government and The Hopi Tribal Council over mineral and grazing rights.

Disputes over the land originate from the negotiations of mineral rights that constructed initial mining operations in the area in the early 1960s. The failure of existing institutions to protect fenceline communities necessitates innovations to protect human, geological, historical, and environmental health. Local fenceline knowledge and citizen science are some of the tools needed to mobilize fenceline expertise to document and share competing narratives of extraction to the Federal administrative law judge overseeing complaints by Black Mesa's fenceline residents. Activating fenceline expertise challenges the narratives of coal producers and the Office of Surface Mining's regulatory experts. These experts champion narratives of good jobs, adequate environmental protection, and risk mitigation. In spite of discursive minimizations of their risk experience, fenceline residents recount immense suffering and hardship from the risks of coal mining and slurry.

Thinking through the insights from critical indigenous theory and environmental justice, I articulate the beginnings of fenceline activist-expert contributions to theorize expertise within fenceline sites. As a legal researcher on the Navajo Nation I tell a story about the challenges, observations, and confrontations with environmental and cultural genocide. In practice many of people in Black Mesa expressed doubts to how another outsider could help their situation? How can the experience of a white, male, paralegal on the reservation translate into something better than just another account for the dustbin of history on another group of subjugated people living in an environmental disaster? How is discourse deployed to sustain privilege and hierarchy of expert knowledge at the expense accounts of fenceline knowledge and experience of risk? Thinking through these questions brought critical insights to my scholar-activist project to cease open burning at the Radford Arsenal.

Chapter 3 mobilizes an insider perspective on the fenceline of my hometown's military industrial facility. I became an activist-expert on the fenceline. This chapter travels across the country to my fenceline community in the water-rich, ancient Appalachian Mountains of Southwest, Virginia, where the national security complex and propellant/explosives producing Radford Army Ammunition Plant was constructed 75 years ago. This plant produces the baseline components for many US Military munitions materials, impacting many people and regions across the world. The facility is consistently ranked the largest polluter in the Commonwealth of Virginia according to the EPA's Toxic Release Inventory.

Experience as a legal researcher on the Navajo Nation forced me to confront the marginalized position of fenceline residents in context to the largest polluter in the Commonwealth. This brought me to 3 years of research on the Radford Arsenal as a scholar-activist in a region devoid of indigenous voices from centuries of genocide. Who would speak for the environment and the fenceline area as Navajo men and women spoke of their mesa under attack by Peabody Coal? I tried to become that voice.

Making the Radford Arsenal the object of inquiry was a radical move in and of itself. RAAP is one of the most taken for granted, least discussed facilities, and socioenvironmental issues in the community of my naissance. Historically little discussion of the facility occurred in the community throughout my formative years within the confines of the ivory tower research university, the son of a mechanical engineer, at Virginia Tech.

This facility is a huge strategic complex of national security. It is managed by the Joint Munitions Command, providing ordnance to all branches of the military. It is a secure facility with a legacy of secrecy dating back generations. The facility is located adjacent and upwind from Blacksburg, Virginia, and Virginia Tech on the ancient New River a few hundred yards downstream from where the regions' drinking water authority takes surface water from the river.<sup>77</sup> Like Peabody's mine it is a large employer in the region. The facility is the second largest employer in the area according to recent discussions in the May 12, 2016 community relations meeting with BAE Systems and the US Army.

My analysis focuses on the disposal of production waste at the site of production instead of where the plant's products are used and deployed. I describe fenceline risk dynamics from the destruction of wastes generated during production through the technique known as open burning. By telling this story I offer insights into the scholar-activist role I helped to play in getting promises of new technology deployed in hopes of reducing and eliminating open burning as an acceptable method of "waste treatment." I became one of the activist-experts operating to ensure accountability and transparency of the facility and its interaction with the fenceline community.

In the first two cases, I demonstrate how weak objectivity produces inadequacies within existing risk discourses and assessments championing the sociotechnical systems' benefit and careful management. At Black Mesa, I show how historical discourse failed to take into consideration the experience of indigenous peoples at the hands of colonizers through the exclusion of fenceline experience, knowledge, and expertise. In Radford, I document the inadequacy of risk assessments in context to the expertise of fenceline knowledge and experience.

Finally, Chapter 4 examines the breakdown of consensus among regulatory experts about the safety of open burning as an acceptable method of hazardous waste disposal. As an outsider, I tell the story of how a grassroots effort successfully implemented the largest and most advanced contained burn system in the world. Unlike coal and explosives production, Minden concerns hazardous waste propellant disposal at the end of a product's lifecycle by open burning. The propellant was stored at the Louisiana National Guard training facility known as Camp Minden formerly the Louisiana Army Ammunition Plant. Events at Minden profoundly influenced fenceline community activists around Radford's fenceline by providing an example of success and model to end open burning.

On Monday, October 15, 2012 an explosion occurred when a storage magazine of improperly stored M6 propellant exploded. Explo Systems initially brought the propellant to Minden to recycle. Instead the contractor improperly stored the material. After the disaster Explo went bankrupt, leaving the hazardous material to deteriorate in unstable conditions conducive to precipitating another explosion.

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<sup>77</sup> See figure 39 which shows how the open burning ground fallout zone encompasses the drinking water pumps for the New River Water Authority at the route 114 bridge.



The disaster prompted the EPA and DOD to take active interest into seeing that the remaining M6 propellant be destroyed by open burning. The unstable propellant had to be destroyed quickly in order to avoid a repeat explosion like the one that jolted the fenceline in 2012. Although government agencies initially proposed open burning, a grassroots citizen's fenceline mobilization forced alternatives to the risky practice. In March of 2015 residents were able to secure a decision to dispose of the propellant using a contained burn chamber with pollution abatement control technology.

I examine the history and risk of the conditions leading up to the controversy of the disposal of M6 propellant at the Louisiana Army Ammunition Plant. M6 and its components were manufactured at the Radford site. The Minden case illustrates the politics of the construction of risk in a community stemming from the proposal to open burn explosives products. Camp Minden is a success story. Concerned citizens succeeded in implementing a sociotechnical fix to safely dispose of unstable propellant after a disaster on the fenceline.

Minden shows how risk calculations of open burning of hazardous waste were directly challenged by fenceline community members who operated as activist-experts mobilizing science, legal research, and non-violent civil disobedience to implement safer alternatives. The inclusion of the fenceline standpoint, through the Camp Minden Dialogue process, enabled a stronger objectivity and resolution of the risk situation that confronted the fenceline, culminating in the deployment of safer technology.

In conclusion, I present three cases of divergent and unique risks that emerge within the fenceline space by showing the important contributions of fenceline experience and knowledge to expertise. I deploy STS concepts to situate controversy over the harms of sociotechnical activities by looking at examples from the beginning of a product to the end of a product's life. Each illustration provides a markedly different model.

Reflexively presenting the cases, I account for my location, resources, and proximity. I tell a story to help scholars-activists, fenceline communities, and outside experts, concerned with environmental justice and risk, further develop the nuance of our understandings into the politics of knowledge and risk in vulnerable locations. I enhance our knowledge over the contestations of risk in the 21<sup>st</sup> century by theorizing the importance of the category of the fenceline expert by combining insights from Epstein, Collins, and Evans with empirical analysis of the fenceline. I reflexively demonstrate how fenceline experience, knowledge, and expertise enables a stronger objective account of risk conditions on the fenceline.

To make the argument that fenceline expertise and knowledge are crucial in the oversight of risky facilities, I show how these sociotechnical controversies construct unique risks for the communities inhabiting their boundaries. Contributing to a robust account of what is at stake in the politics of risk and knowledge on the fenceline, I describe the latent politics of knowledge and risk within three separate sociotechnical controversies on the fenceline. Using a Dadaist *mélange* of methods, I present an account of environmental struggle in the Anthropocene by borrowing from the fields of critical indigenous theory, critical discourse analysis, science and technology studies, qualitative research methods in sociology, environmental studies, and environmental justice scholarship to communicate fenceline contestations over the politics of knowledge of risk.<sup>78</sup>

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78 S. L. Lewis and M. A. Maslin, "Defining the Anthropocene," *NATURE* 519, no. 7542 (2015).

I offer demonstration to situate how qualitative scholar-activist research can be operationalized to strengthen objectivity of fenceline conditions. Illustrating promises through the practice of scholar-activist reflexivity, this research highlights the challenges scholar-activist researchers experience while conducting research in a world guided by neoliberal ideology wrought with contradiction, struggles, funding, and location constraints.<sup>79</sup> I present an *essai* through which the norm of communicating fenceline experience with risk is privileged to broaden our insights into the conditions on fencelines.<sup>80</sup>

This account of environmental inequality, risk, and expertise takes the form of a testimony akin to longstanding western tradition of offering a *témoignage*.<sup>81</sup> I testify in each socioenvironmental context by mobilizing innovations in the practice of scholar-activist research to recognize my location as a white male, western-educated, PhD student. *Témoignage* is well accepted inside the cannon of western thought dating back to the writings of Montaigne, Rousseau, and the contemporary, Roland Barthes.<sup>82</sup> Testimony to the fenceline standpoint offers the possibility to strengthen our sociological understanding of the experience of risk in fenceline communities by mobilizing declarations of experience similar to the eye-witness testimonies marshalled in the justice system. This fenceline interpretation, through the framework of academic research, offered by the privilege to complete a PhD at Virginia Tech, recognizes inherent limitations in access to resources for scholar-activist researchers working inside the contemporary neoliberal constraints of the institutionalization of academic inquiry.

I testify to the vast inequalities, symbolic and actual violence, experienced by those who live amidst high risk produced by anthropogenic sociotechnical systems. Inclusion of the standpoint of the fenceline into a program of research operationalizes, strengthens, and empowers the scientific understanding of the latent contestations over the politics of knowledge and expertise of risk within environmental justice movements. At its basis, this scholar-activist environmental research empowers the concept of the fenceline, actively seeking to minimize risks, through the sharing of fenceline knowledge and expertise with other scholar-activists and concerned citizens working in pursuit of environmental justice in the contested spaces of industrial pollution.

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79 In all three cases social media has shaped the consciousness of fenceline struggles by the rapid dissemination of information beyond the fenceline to a potential global audience. The concerned citizens of the Camp Minden M6 Open Burn Facebook group is a repository of information detailing the struggle to challenge and implement alternatives to open burning.

80 The conception of an *essai* or trial attempts is well documented within the canon of western literature. See: Montaigne's *Les Essais*.

81 Jean-Jacques Rousseau and Jacques Voisine, *Les Confessions*, vol. Éd. illustrée (Paris: Éditions Garnier frères, 1964).

82 Roland Barthes, *Roland Barthes* (Paris: Éditions du Seuil, 1995). Rousseau and Voisine, Éd. illustrée.

## Chapter 2: Mythologies of a Coal Slurry Line: Excluding Fenceline Knowledge and Expertise

### *Introduction:*

The Southwestern United States is a laboratory of controversy at the intersection of science, technology, and society. Technical systems of energy development in the region form the central arena of contestations intersecting the politics of land and the cultural meaning of the landscape between the dominate society and indigenous people. The relationship between rural areas of energy extraction and the urban metropolises of the Southwest United States can be understood through an investigation into the history of energy production and distribution from these rural areas, to final concentration, and articulation of power in the cities.<sup>83</sup>

These immense systems produce the energy necessary for the urban development of Los Angeles, Phoenix, Tucson, and Las Vegas. Particularly important in the vast networks of power enframing the land is the mining complex on Black Mesa, Arizona.<sup>84</sup> The relationship between urban metropolises and rural regions of the Southwest can be examined through an investigation into the energy production and distribution networks from the rural areas to the consumption points in the city power and water networks. Large socio-technical networks produce the water and energy necessary for urban development and culture.

The socio-technoscientific systems, symbolized by the Hoover Dam and the Glen Canyon Dam, known to many Americans, constitute the largest scale construction projects ever undertaken in the west. Construction began a period of immense expansion for the development of socio-technoscientific systems required for urban industrial development in the southwest after the nuclearization of the landscape of the desert southwest during the Manhattan Project.<sup>85</sup>

In the 1960s and 70s the region turned to systems of energy production fueled by massive coal burning electric generating stations. These plants, often collocated with nearby dams, were situated far from the urban cities enframing the landscape of the southwestern United States.<sup>86</sup> The

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83I adopt the network approach in Science and Technologies studies developed by Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983). Hughes' work contextualizes how the extraction of energy can be conceptualized in terms of network with nodes, centers, and distribution. Therefore, I look at the intersections between where power is produced and the relationship of the production point to where it is consumed symbolized by the slurry line.

84Martin Heidegger, *The Question Concerning Technology, and Other Essays* (New York: Garland Pub, 1977). Black Mesa is revealed as merely a place where energy is located through the construction of extractive energy systems. People are viewed as indispensable by the utilities seeking the cheap coal under the soil. Forced relocation of traditional indigenous people is the preferred method to access the resources. The Federal Government owns the majority stake in NGS with the Bureau of Reclamation holding a 24.3% share, Salt River Project 21.7%, LADWP 21.2%, Arizona Public Service 14.0%, NV Energy 11.3% Tucson Electric Power 7.5%.

85 Valerie L. Kuletz, *The Tainted Desert: Environmental and Social Ruin in the American West*, 1 ed. (Routledge, 1998).

86 For example Valerie Kuletz states, "The region I study has become very much a scientific-landscape—indeed, certain areas are often referred to as "outdoor laboratories"—and science helps designate the region not only as a weapons testing ground but also as a nuclear wasteland. Scientific discourses and representations legitimate the designation of areas within this region as toxic and nuclear waste dumping grounds—a particularly brutal objectification of the non-human world." Within the space surrounding Los Alamos and the Nevada Test Site, we witness enframing of nature through a variety of mechanisms from uranium mining, displacement of persons, pollution, testing, and disposal of hazardous materials in which these elements become merely energies to be ordered for further use. See: *ibid.*, xvii. See: United States Environmental Protection Agency, "Addressing Uranium

construction of these systems after World War Two breathed fossil fueled, dam constructed, industrial culture into the vastness of the desert. Construction of water/power facilities transformed the interactions between technoscientific and indigenous communities. Altering the landscape, these systems continue to be at the center of political contestations over land and the future of development in the region. They are the defining locations of anthropogenic architecture enframing the landscape.

As a political artifact the construction of the Black Mesa coal slurry pipeline embodied a temporary stabilization of an urban controversy. Controversies over environment, power, and water occurred during a period of immense urbanization in the Southwest. The sociotechnical fixes implemented to solve urban controversies embedded social and material arrangements of land use, socioenvironmental risk, energy production, water-use, and labor/capital relations through the construction of large sociotechnical systems in distant places. The stabilization of urban sociotechnical controversies over power, water, and the environment simultaneously produced a destabilization of the extractive region by producing a fenceline community through the construction of the systems of energy and water extraction.

The Black Mesa mining complex contains two surface coal mines: the shuttered Black Mesa Mine and the operational Kayenta Mine.<sup>87</sup> The Black Mesa Mine closed down in 2005 after its water permit for slurrification was revoked by the EPA. The current struggle over the operating status of the mine epitomizes the tumultuous contestations over the politics and knowledge of risk and created by the fenceline experience with the political artifacts of power and water production of distant metropolises.<sup>88</sup>

Throughout many trips to Black Mesa, in the conduct of legal research, I learned that the transportation of coal ceased at the Black Mesa Mine due to reemergence of conflict over the generation of power and water because of the unsustainability of pumping nonrenewable groundwater to slurry coal in an arid climate. The pipeline transported pulverized coal and water in the world's longest experimental coal slurry pipeline 285 miles over desert and mountain terrain to the mega coal boilers at the Mohave Generating Station.

The stabilization of urban power, water, and environmental controversies in the early 1960s proved temporary as the same environmental pressures, confronted initially by urban populations, were reproduced in the newly created fenceline of faraway extraction sites. Immediately, fenceline experience and knowledge came to challenge the use of coal for electricity and water production. These challenges arose directly from the onset of construction of power and water projects championed by urban utility companies who built the fencelines.

The perceived stabilization, evident in newspaper articles from the time, reveals how large scale extraction projects attempted to temporarily resolve questions about how to provide energy and water to large metropolises in the desert southwest.<sup>89</sup> Concurrently the urban stabilization of

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Contamination on the Navajo Nation | Superfund | Pacific Southwest," <http://www.epa.gov/region9/superfund/navajo-nation/files/89/navajo-nation.html>.

<sup>87</sup> Marsha Monestersky, January 7, 2013 recorded public comments submitted to US EPA on Bart Permit Renewal. At one time Black Mesa was the largest surface mine in North America, surpassed after the development of coal extraction in the Powder River Basin of Wyoming.

<sup>88</sup> For pictures see the figures section which provides visual information about the site.

<sup>89</sup> Navajo traditional leaders emphasize that the beginning of large scale coal mining on their lands constitutes a new chapter or controversy in their history to survive beginning with contact with European settler-colonialists. When I

power/water controversies brought new disruptions inside the colonial spaces of the Native American reservations in Four Corners. Locating large coal fired power generating stations in indigenous spaces unsettled traditional lifestyles, depleted aquifers, jeopardized water and air quality, fostered inter-tribal conflicts over mineral resource ownership, and industrialized sacred landscapes.

Outsourcing fossil fuel power projects required the extraction of large amounts of water and coal from the sacred landscape of the Hopi and Navajo reservations. Today, extraction continues to challenge indigenous identities. Tribal identities were destroyed through forced relocation to make way for the technical networks of energy and water production. Those that survived responded by mounting immense pressure for environmental justice by creating resistance movements championing Mother Earth's sovereignty. Today, many of Black Mesa's fenceline residents actively seek to end extraction, conceptualizing resource colonialism as an ongoing assault on traditional culture.

Within this ancestral land, divergent visions of development, energy production, indigeneity, politics, technoscience, and environmental concerns converged. Opposing cultural claims of knowing, being, and living with the land intersect amidst the industrial spaces of the artifacts of extraction.

The production of risk by largescale power and water systems created new contestations within the landscape through the creation of a fenceline. The disruption of the land threatens traditional ways of living, historically grounded in the landscape. Fenceline controversies on the reservation mirror conflicts in the urban metropolises of the Desert Southwest over the sourcing of power and water. Modern civilization in the desert climate inscribes contestations over the politics of energy, climate, water, environment, and culture. Decisions to develop casinos on Native American land, nuclear power, nuclear weapons testing, uranium mining, mega-dam projects, water projects, fracking, coal extraction, and indigenous land rights are a few among the many controversies.

The common denominator linking many of the diverse polemics of the region, from the urban to the rural, is the politics of water and electricity production; no better symbolized by the coal slurry sociotechnical system of the Black Mesa Mine. Deployment of these power/water systems turned the entire southwest into a laboratory the urbanization of the desert through the operation of large scale energy and water projects. These projects came together, converging to create the cities, after water and power journeyed hundreds of miles through pipelines and railways, flowing from mines to the coal-fired electric generating stations, all networked through a patchwork of huge high-voltage transmission lines, pumping stations, aqueducts, and canals.

### ***Theorizing the Laboratorization of the Fenceline in Context to Risk:***

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describe stabilization I am speaking from the perspective of the urban cities whose demand for electricity and water as a necessity of modern life challenged tradition native epistemology and ontology. The notion of stabilization is problematic depending on which perspective the inquirer chooses to follow. To the Navajo traditional leaders stabilization in the urban cities came with a reaction of causing great destabilization in their homeland. I contend that this destabilization was genocidal as it targeted and destroyed many identities of traditional Navajo culture by disrupting traditional ways of living with the land. Tradition fenceline residents emphasize how their grounded lifestyle, long evolved by working within the constraints of the environment, is under threat because of the disruptions of local environment from high risk extraction.

The enframing of the environment through construction and operation of the coal/power/water complex of Black Mesa laboratorized the region as a place of extraction. The era of the Anthropocene understands that humans are capable of fundamentally changing the landscape, geology, and chemistry of the planet by industrial activities.

Methodologically, I argue that fenceline research should operationalize STS's robust insights of the creation of scientific knowledge within micro-laboratory conditions to the macro-level of risky fenceline sites. Ulrich Beck in the *Risk Society* presents a framework for understanding the macro-laboratorization of society as a result of the creation of toxicity, risk and pollution from large industrial technoscience. Often, as in the instance of nuclear radiation releases to the environment, risk is only perceivable through the resolution of technoscience. The risk society is characterized by invisible risks and unknown threats. While technoscience may produce risk, sometimes the only way we can understand risk is through the application of technoscience. This is the condition defined by Beck as a component of reflexive modernity.<sup>90</sup>

Early STS research comprises a rich literature of ethnographic studies of the production of knowledge in micro-laboratory spaces. Bruno Latour's *Laboratory Life*, longstanding traditions of the Social Studies of Science of the Bath School, and the Empirical Program of Relativism (EPOR) developed by Harry Collins and the Bloor/Barnes strong program of the Sociology of Scientific Knowledge (SSK) comprise fundamental contributions to the early emergence of STS on the construction of scientific knowledge in micro-laboratory spaces.<sup>91</sup> The Bath School emphasized studying laboratories and experiments using ethnographic inquiry in order to approach scientific knowledge through micro-sociological studies rather than the more historical studies of the SSK. The Sociology of Scientific Knowledge, on the other hand, utilized historical and sociological forces to account for the explanations of scientific ideas by describing the roles of institutions in the conduct of science.<sup>92</sup>

In the Anthropocene's risk society, I reimagine these early methodological contributions to theorize a program of research to study how knowledge is created in the socioenvironmental laboratory of macro-level extraction systems. This approach illustrates the nuances of the politics of knowledge and risk in a landscape laboratorized by the deployment of large scale extraction artifacts. The slurry pipeline is macro-laboratory embedding knowledge claims, technoscientific practices, and experimental risks of an extraction system. We can understand the concept of the fenceline as one location inside the macro-laboratory experiment of technoscientific production on humans and non-humans enabled by powerful technological systems.

The laboratorization of the socioenvironment, through the construction of the coal slurry line, created new experimental risks for fenceline residents living along the slurry line and within the mining complex. In "The Politics of Knowledge in the Risk Society" Ulrich Beck argues that society is becoming a laboratory.<sup>93</sup> As unknowns proliferate from technoscientific activities,

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90 Ulrich Beck, *Risk Society: Towards a New Modernity, Theory, Culture & Society* (London ; Newbury Park, Calif: Sage Publications, 1992).

91 Bruno Latour, *Laboratory Life: The Construction of Scientific Facts* (Princeton, N.J: Princeton University Press, 1986). H. M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (Chicago: University of Chicago Press, 1992). Barry Barnes, David Bloor, and John Henry, *Scientific Knowledge: A Sociological Analysis* (Chicago: University of Chicago Press, 1996).

92 H. M. Collins, "Introduction: Stages in the Empirical Programme of Relativism," *Social Studies of Science* 11, no. 1 (1981).

93 Beck, 69.

people impacted by the laboratorization of the socioenvironment increasingly lack the ability to adjudicate and assess knowledge about their risk due to the proliferation of unknowns, uncertainty, and disruption of cognitive sovereignty. Traditional ways of knowing and being, grounded in landscape and place, are fundamentally challenged by anthropogenic extraction.

Fenceline communities members often lack the necessary tools to determine risk because “...the experiment on people does take place, but invisibly, *without* scientific checking, *without* surveys, *without* statistics, *without* correlation analysis, under the condition that the victims are *not* informed—and with an inverted burden of proof, if they should happen to detect something.”<sup>94</sup> Beck states, “In this way, risk positions create dependencies which are unknown in class situations; the affected parties are becoming *incompetent* in matters of their own affliction. They lose an essential part of their cognitive sovereignty.”<sup>95</sup> The loss of cognitive sovereignty in Black Mesa’s extraction zones was produced through the construction of the fenceline. Fencelines are laboratory sites that are produced through the disruption of environmental sovereignty prompted by large-scale risky technology. The massive disruption of traditional lifestyle and laboratorization of the landscape coproduced the Black Mesa fenceline.

Dominant discourses of risk were constructed by the pipeline’s stakeholders which included regulators far from the social situatedness of fenceline experience. The construction of the coal slurry pipeline reveals a crucial examples into the loss of cognitive sovereignty in the risk society. Risk assessments of technoscientific activities are conducted through technoscience. Many risks can only be assessed through technoscience, with significant unknown consequences. Extraction technologies create risks only perceptible through scientific and technological knowledge and expertise. This is the condition of reflexive modernity discussed by Beck. The risk society is defined by the proliferation of unknown consequences which can only be resolved through scientific study. The slurry systems created risks, now being perceived with significant disruptions of climate caused by the burning of fossil fuels. At the time of the early construction of massive fossil fuel infrastructure these climate risks stood outside of the evaluative capacity of technoscience.

The proliferation of unknowns ought to dictate that the fenceline experiences should be thoroughly monitored to minimize risks. In Black Mesa risk became divorced from traditional experience; threatening indigenous cognitive sovereignty and the peoples’ ability to continue with their traditional lifestyles of shepherding inside the mining area. With the arrival of extraction, fenceline residents were able to recognize and predict the disruption to places caused by the pipeline’s extraction, but lacked the power to challenge the dominate knowledge by extraction proponents. Residents recount that the pipeline threatened traditional culture, knowledge and experience, but could not supply the data necessary to quantify their risk because their standpoint was marginalized by the extractors. To increase our objective understanding of risk, the people of the fenceline should be actively enrolled and allowed to participate in the decision making processes of risk assessment construction. The proliferation of unknowns and uncertainty in the risk society necessitates the enrolment of the full range of perspectives, knowledge, and experience of those living next to risky technoscientific systems.

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94 Ibid.

95 Ibid., 53.

To present the contestations over knowledge, risk, and expertise within fenceline I tell one narrative, among many potential narratives, of the pipeline. I prioritize the agency of the slurry line as an experimental project in extracting and transporting Earth's resources. This approach reimagines the traditional laboratory studies of STS to the macro-level examination of the politics of knowledge and risk within fenceline experiences of extractive risk. Sergio Sismondo in *The Handbook of Science and Technology Studies* explains:

Actor-network (ANT) further broadens that picture [symbolic interactionist approach where science and technology are conceptualized as work] by representing the work of technoscience as the attempted creation of larger and stronger networks (Callon, 1986; Latour, 1987; Law, 1987). Actors, or more properly 'actants,' attempt to build networks we call machines when their components are made to act together to achieve consistent effect, or facts when their components are made to act as if they are in agreement....ANT might be seen to combine the interpretive frameworks of EPOR and SCOT with the materialism of laboratory studies.<sup>96</sup>

The coal slurry line is the artifact that links together the many actants across the network of extraction from the urban metropolises to the reservation. The social dimensions of science and technology cannot be separated from one another. I understand the two domains of science and technology as fundamentally linked: technoscience. The politics contained within the coal slurry artifact constitutes a way to understand controversy at the intersection of science, technology, and society.

I theorize the relationship between science and technology as bounded together by the construction of the coal slurry laboratory landscape. My inquiry into the construction of a socio-technical network for transporting coal in the Southwestern United States commits heavily to intellectual development of Science and Technology Studies in understanding the social situatedness of knowledge in context to the intersection of technology, science, and society of the macro-laboratory of the risk society.<sup>97</sup>

As an agent testifying to experience, I communicate what was observed during my time on the Navajo Reservation, as a member of a legal research team, in order make the case for stronger objectivity in the account of the coal slurry pipeline by mobilizing the importance of the fenceline standpoint.

I recall information learned from conversations, notes, and statements submitted to the EPA as part public comments on permitting actions. Our team worked on a legal case in opposition to the expansion of the active Kayenta Mine. Peabody sought approval from the Department of

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96 Edward J. Hackett et al., eds., *The Handbook of Science and Technology Studies*, third edition (The MIT Press, 2007), 16.

97 I do not distinguish system and network for the sake of brevity. However, the idea of technological system comes from the work of Thomas P Hughes, "Technological Momentum." In *Does Technology Drive History? The Dilemma of Technological Determinism*, edited by Merritt Roe Smith and Leo Marx, 101-13. (Cambridge: MIT Press, 1994). Latour defines networks. He states, "If technoscience may be described as being so powerful and yet so small, so concentrated and so dilute, it means it has the characteristics of a network. The word network indicates that resources are concentrated in a few places—the knots and the nodes—which are connected with one another—the links and the mesh: these connections transform the scattered resources into a net that may seem to extend everywhere," in Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Cambridge, Mass: Harvard University Press, 1987), 180.



Interior's Office of Surface Mining Reclamation and Enforcement for a proposed life of mine permit that would fold the closed Black Mesa Mine into the active Kayenta Mine.

I draw upon the work of Leon Anderson in "Analytical Autoethnography." Anderson explains five key tenants of analytical autoethnography arguing "(1) complete member researcher (CMR) status, (2) analytic reflexivity, (3), narrative visibility of the researcher's self (4) dialogue with informants beyond the self, and (5) commitment to theoretical analysis."<sup>98</sup> Powerfully, Anderson makes an argument about the importance of understanding the intersection between biography and society; self-knowledge that comes from understanding our personal lives, identities, and feelings as deeply connected to and in large part constituted by—and in turn helping to constitute---the sociocultural contexts in which we live.<sup>99</sup> I present my project reflexively in full commitment to these norms.

Reflexivity is crucial to sociological research. I do not pretend to hide my agency in this story of the coal slurry line. Instead I depict my struggle to make sense of competing discursive voices I encountered in historical texts with the experience of witnessing the violence of coal extraction resource colonialism on the fenceline in order to theorize fenceline laboratory risk.

I adopt a first person reflexive account of the coal slurry line on Black Mesa. Responsibility for the choices regarding how I represent the sources, as I do, lies squarely with me. As Deborah D'Amico-Samuels reminds us in "Undoing Fieldwork: Personal, Political, Theoretical and Methodological Implications":

...we cannot leave ourselves out of the analysis. Our translation of the experiences of the world's exploited peoples into language understood by those with access to greater power than themselves is useful only insofar as it prompts us to ask questions about the nature of this power in our own lives and work and work as it spurs our contribution to attempts to alter the global balance of power responsible for their poverty and oppression.<sup>100</sup>

Reflexivity is the process through which we include ourselves in the analysis. We need to question the roles we play with respect to those who encounter through research. Importantly, D'Amico-Samuels problematizes the concept of the field in ethnography as an ideological concept which eradicates false boundaries of time and space by obscuring identity. She questions the conception of fieldwork as a mode of colonial representation. She argues, "...today's reflexive anthropologists begin from the assumption that ethnography as both process and product needs to be deconstructed."<sup>101</sup> Rather than deconstruct, my project, constructs, with reflexive awareness of the major issues confronting fenceline researchers in resource colonial spaces. I make explicit how a legal researcher relates the sociotechnical history of a technoscientific extractive artifact.

By engaging reflexivity other questions emerge for the researchers who must confront questions of accuracy, representation, "good" method, and the presentation of a well-constructed depiction of the account. Thus, issues of reflexivity are inevitably bound with the questions of good research. Normatively, I must be absolutely self-reflexive if readers are to understand the how and why of this account. By committing to reflexivity it is my hope that my readers might

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98 Leon Anderson, "Analytic Autoethnography," *Journal of Contemporary Ethnography* 35, no. 4 (2006): 378.

99 *Ibid.*, 390.

100 Faye V. Harrison, ed. *Decolonizing Anthropology: Moving Further toward an Anthropology for Liberation*, 2 ed. (American Anthropological Association, 1997), 82.

101 *Ibid.*, 69.

understand a bit about how, I, as author, structure and code the work that is presented. Through reflexivity I arrived at a conception of my study as a semi-autobiographical account of a legal researcher's on a fenceline.

This project did not fall out of the sky; rather, my embeddedness in a network of public interest-environmental law attorneys led me to region of the southwest United States and informs my approach and reasons for why the project deserves attention within scholarship. A major question informs my research: how can understanding the coal slurry line in both its historical and present context assist environmental justice research in current contestations over the present situation of Peabody Coal's bankruptcy and Kayenta's mine-to-mouth operations in the face of a vanishing Lake Powell?

### ***Situating the Emergence of the Black Mesa Fenceline and the Land Dispute:***

Black Mesa is situated on the Navajo and Hopi reservations on the Colorado Plateau in Northeastern Arizona near the Four Corners. Black Mesa is the homeland to both the Navajo Nation Diné (People) and the Hopi Tribe. Traditionally the Navajo people are migratory, herding sheep; adopting a nomadic way of life. The Hopi are a settled-agricultural society living in villages along the edges of the cliffs of the three mesas in the region, including Black Mesa. The tribes have traded with each other for generations. Authors of the 1971 white paper *Environmental and Economic Issue: The strip mining on Black Mesa and the coal burning power plants in the Southwest* explain:

First of all, Black Mesa is a part of the Colorado Plateau and what is generally referred to as the Painted Desert. It is the dominant topographic feature of the western portion of the Navajo Indian Reservation. The three 'mesas' on which the Hopi Indians long ago established their pueblos are actually the ragged 'fringes' which resulted from the erosion of the southern end of Black Mesa.<sup>102</sup>

The Diné and the Hopi both refer to Black Mesa as their homeland. Britt Dveris in *Environmental Justice on Black Mesa*, describes: "The area was one of the earliest homelands of Native Americans, with recent archaeological finds indicating a presence 38,000 years ago.... [It remains] one of the greatest concentrations of indigenous people in the country."<sup>103</sup> The longstanding presence of humans in this area is evident by the cultural diversity of the region where ruins, burial grounds, and other cultural artifacts mark the landscape. Navajo Hogans, Hopi Pueblos, and Anasazi dwellings and granaries testify to the cultural diversity of shelter technologies in the harsh climatic conditions of the region dating back centuries before the white man arrived.

Black Mesa is an area of special cultural and spiritual importance, significant to both the Hopi and Navajo cultures due to the longtime settlement of the area by humans. However, it is one of the most extracted resource regions in the country. Coal from the Black Mesa Mine was transported in the world's first and longest experimental coal slurry line 285 miles across mountain and desert terrain to the 1580 MW Mohave Generating Station. According to the Natural Resources Defense Council's report, over 44 billion gallons of water were extracted to transport

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102 Many Farms High School, *Environmental and Economic Issue: The Strip Mining on Black Mesa and the Coal Burning Power Plants in the Southwest* (Many Farms High School., 1971), 3.

103 Britt Dveris, *Environmental Justice on Black Mesa: Balancing Energy Development with Traditional Cultural Values*, 1999, 22.

the coal via slurry throughout Mohave's existence.<sup>104</sup> Water extraction was the primary reason for the revocation of Peabody's Black Mesa Mine water permit.

The construction of the experimental coal slurry pipeline laboratorized the reservation. The pipeline enframes vast areas of the natural environment as extraction standing-reserve by forever altering the local place for energy production. The pipeline created risks for those living near its origin, path, and termination while temporarily minimizing risk from power generation for people in the urban centers far from the direct risks of extraction. The emergence of the Black Mesa slurry line intended to resolve a sociotechnical controversy emerging from of urban contestations over environment, water, and energy.<sup>105</sup>

During the 1950s and 1960s tribal governments were reorganized by the United States' government in order to facilitate the signing of leases for indigenous mineral rights with multinational corporations, specifically, Peabody Coal Company.<sup>106</sup> To achieve the relocation of people living in the mining area the modern Hopi Tribal Council and Navajo Nation systems of government were established in consortium with Mormon attorney John Boyden.<sup>107</sup> Boyden represented the Hopi Tribal Council and mining interests including Fisher Contracting Company, Aztec Oil and Gas Co., Western Energy Supply and Transmission Associates (WEST) which included Peabody Coal, Bechtel and Kennecott Copper.<sup>108</sup>

Boyden was the primary architect behind the use of the joint use area in Black Mesa for extraction. The joint use area was a piece of land shared by the Hopi's and Navajos that was at the root of the 43 year land-dispute (1966-2009) between the two tribal governments, known as the Bennett Freeze.<sup>109</sup> As a result of Boyden's maneuverings, Peabody was awarded its first lease at the Black Mesa Mine 40 Miles to the Southeast of Kayenta Arizona in 1964. 1966 is the year which Peabody Coal Company was granted the right to mine 64,000 acres or land in the Black Mesa area. 40,000 acres of this land lay within the joint-use area and the rest was on Navajo Land. The joint-use area was established to deal with the fallout of reservation partitions in which the Hopi Tribe found their reservation entirely encircled by the Navajo Nation.<sup>110</sup> Each tribe would receive 50-50 royalties for the coal mined.

The implementation of coal extraction in the region during the 1960s pitted the two tribes against each other as a result of the maneuvers of outside mineral resource interests to secure access to water and energy. Historically, Mormon interference in western Native American affairs

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104 National Resources Defense Council, "Drawdown: An Update on Groundwater Mining on Black Mesa," National Resources Defense Council, <https://www.nrdc.org/resources/drawdown-update-groundwater-mining-black-mesa>. There are considerable unknowns about the exact amount extracted.

105 One can certainly argue that the risk of burning coal were reduced for the Urban Centers, but now science is helping to illustrate the consequences of fossil fuel

106 Peabody Coal Company is now was known as Peabody Western Coal Company. For simplicity, I refer to it as Peabody.

107 I am not going to detail the politics of how the reservations were created or the history of the land dispute. However, a corrupt attorney played both the Hopi side and the Navajo side at the same time he represented the interests of the energy companies. For more information on John Boyden please see the Boyden Papers housed in special collections at the J. Willard Marriott Library at the University of Utah in Salt Lake City.

108 National Resources Defense Council.

109 See figures for photos of conditions in the former Bennett Freeze.

110 Deborah Lacerenza, "An Historical Overview of the Navajo Relocation," Cultural Survival, <https://www.culturalsurvival.org/publications/cultural-survival-quarterly/united-states/historical-overview-navajo-relocation>.

is well documented and included the kidnapping of Navajo and Hopi children into forced reeducation schooling by Mormons. The genocidal efforts to destroy native culture in the United States was consistent with Bureau of Indian Affairs reeducation policies of the late 19<sup>th</sup> and early 20<sup>th</sup> century. These systems of reeducation were designed to begin where the bullet ended. Reeducation schools served systematic efforts to undermine tribal identity and eradicate tribal language in order to create an assimilated class of natives in American society. The Western Peabody Coal Company's campaign began where reeducation ended.

However, joint ownership of the land made negotiations with mineral companies nearly impossible. The land had previously been shared, used by mainly Navajos, because the Hopi lived in villages at the edge of the Mesa. In 1970 under increasing pressures for royalties from mineral extraction the Hopi council authorized the impoundment of all Navajo livestock on Hopi land.<sup>111</sup> Impoundment actions represented an attack of on traditional Navajo culture. Livestock husbandry provides many Navajo with their incomes and means of survival. Some traditional grandmothers refer to livestock as money in the bank; much more useful than paper money.<sup>112</sup>

The governments codified the groups of people into formal organizations which could negotiate mineral concessions with an appearance of tribal democracy, adopting a logic of bureaucratic organization. These tribal governments created hierarchy and bureaucratic departments ranging from housing, animal grazing, utilities, environment, and mining extraction to regulate tribal life according to modern nation-state institutional norms.

Furthering the dislocation caused by livestock impoundment, Boyden would press the US Congress for the passage of the Navajo-Hopi Land Settlement Act, or Public Law 93-531, which authorized partition of the Joint Use Area by declaring a range war imminent.<sup>113</sup> Accounts of how the range war was exaggerated up by Boyden, in Washington, were discussed over and over again by traditional people during my time as a paralegal on the reservation. Boyden was the mastermind who played both sides, representing the Hopi and the mineral companies, simultaneously dividing the people through the manufacturing of a land dispute between the two tribes.

In 1974, President Ford signed Public Law 93-531. The joint-use area was partitioned into Hopi Partitioned Land (HPL) and Navajo Partitioned Land (NPL).<sup>114</sup> The partitioning of the land was a strategy to pit the Navajo against the Hopi for the purposes of a smoke and mirrors tactic to distract the people, on both sides, from the common enemy of the destruction of their cultures by Peabody Western Coal Company. Revenue from resource extraction royalties was used to divide and conquer. According to some accounts, traditional Hopi and Navajo leaders did not see a land dispute between themselves. The tribal councils installed by the Bureau of Indian Affairs (BIA), Boyden, and Peabody argued that an existing dispute and imminent range war would occur between the two tribes if the land was not partitioned and a fence constructed. Coal would be at

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111 Lacerenza explains: "It is this 1882 Executive Order Reservation, later known as the Joint Use Area (JUA), which was divided in half by the 1974 Land Settlement Act. From the time of its inception it was occupied by both Navajo and Hopi people. With the encroachment of white ranchers and the Atlantic and Pacific Railroad in New Mexico, more and more Navajos moved west into the JUA. Despite overcrowding, the two tribes managed to peacefully coexist except for some minor squabbles over land and water use."

112 Maria Florio and Victoria Mudd, "Broken Rainbow," (Earthworks Productions, 1985).

113 Ibid.

114 For a picture of the fence see the figure sections

the root of the manufactured conflict. Today, livestock impoundment continue as the dispute is ongoing with many Navajo resisters continuing to occupy their traditional homesteads on HPL.

Some accounts emphasize how traditional leadership on both sides did not acknowledge a land dispute and were unified against the extraction of coal.<sup>115</sup> However, we know that traditional leadership was deliberately excluded through the creation of the corporate tribal councils. Many Navajo elders recounted that they have lived in peace with the Hopi. Activist outsiders spoke of how Hopi elders shared similar views with the Hopi. I cannot substantiate either claim. Throughout our legal research there were many people we encountered who would echo the sentiment of coexistence.

Nevertheless, the corporate councils were in conflict over the territory because of the vast amounts of coal and other profitable resources due to perspective royalties. Boyden successfully maneuvered and succeeded with his plan for division. The consequences of this land dispute cannot be quantified as between 12,000 and 20,000 Navajo were relocated from HPL.<sup>116</sup> Between 12,000 and 14,000 people were forcibly relocated in just 6 years after the passage of the law. 90% would die within 6 years.<sup>117</sup> Relocation is genocidal. Depriving people of their primary means of subsistence, relocation shuttered the bank of traditional animal husbandry that many relied on for subsistence. Many people who were relocated died soon after, and were relocated to land contaminated with radiation from uranium like Sanders, Arizona.<sup>118</sup> Today, Peabody continues to push for relocation policies to move residents off of land with desirable coal deposits. Relocation broke traditional connections to the land.

Part of the relocation effort was the creation of the Bennett Freeze which froze new construction and maintenance of existing structures in any lands party to the dispute on the western third of the Navajo Nation. The freeze was authorized by executive order in 1974 by President Gerald Ford during a skiing holiday in Colorado.<sup>119</sup> The Bennett Freeze sanctioned forced relocation of the traditional Diné out of Big Mountain and HPL to other locations on the Navajo Nation so that Peabody could operate without resistance. The freeze impacted communities far beyond Black Mesa, including those in the western portion of the reservation like Cameron, Bodaway-Gap, Wupatki, and Grey Mountain.

The Freeze prevented the maintenance of any existing building or the construction of new structures on an area of 2 million square miles. Kate Linthicum describes:

Some people found ways to evade the freeze by building horse corals slowly, post by post, to avoid attracting attention from Hopi rangers who circled overhead in helicopters. Others camouflaged improvements by remodeling only the inside of their homes. [Larry] Gordy's family stored the hay for their horses in a junked bus and built their corral on the side of a

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115 Florio and Mudd.

116 Bill Curry, "Relocation Deadline Arrives but Navajo Have Won Reprieve," Los Angeles Times, July 06, 1986 1986.

117 Florio and Mudd.

118 The subject of Uranium mining on the reservation is another project, though there are many parallels with coal mining.

119 Florio and Mudd.

sandstone rock, where it was somewhat hidden. But they couldn't hook up to water or electricity. Eventually the hardship drove them out.<sup>120</sup>

The Bennett Freeze ended in 2009, but the impacts continue to reverberate.<sup>121</sup> The cost of prohibiting construction and maintenance is severe. Many generations of people were denied a right to life, self-determine, and provide for their families. The freeze stripped them of the means to graze animals and farm. Environmental sovereignty was taken from the people. The freeze constructed poverty through policy. An analogue of this method can be found in the Palestinian territories where Israel has cut off Gaza from the outside world through the systematic denial of the right to self-determination through encroachment by settler colonies. Today, conditions in the former Bennett Freeze area today testify to the legacy of the denial of subsistence and basic human rights by the federal government and State of Arizona.<sup>122</sup>

Whether forced out by BIA officials, Hopi Rangers, or by the hardships encountered by living in a “frozen” area, the policy of public law 93-531 was genocidal. The construction of fences separated families, blocked needed grazing land, and shut off access to essential wind-powered water wells for Navajo families who rely on water for animal husbandry and subsistence.<sup>123</sup> Deborah Lacerenza explains:

Rather than employing military force, the federal government undertook a war of attrition designed to destroy the peoples' ability to remain on the land. It implemented a building moratorium which made it illegal for people to build or even repair their homes, corrals and so on, and a livestock reduction program which limited the number of stock animals a family could own. Because traditional Navajo economy is based on livestock (sheep in particular), these programs represented a direct threat to survival.<sup>124</sup>

Even with the lifting of the freeze in of 2009, 90% of families within the freeze area still lack electricity and less than 3% have access to running water.<sup>125</sup>

The freeze produced and reinforced inequalities. It produced the construction of many fencelines across the reservation along the pipeline route, by creating conditions for the emergence of a sacrifice zone within Black Mesa. Within this context the large scale socio-technical systems of electricity generation would be built. Mineral resource extraction colonialism continues the exploitation of indigenous people sentenced to genocide by the United States Governmental policies of relocation and the freeze. Today, relocation is still pursued in the Peabody Mining Area. Fenceline residents often spoke of a Peabody Freeze in which they cannot build or maintain roads and buildings; living in fear of continual trespassing violations or livestock impoundments.<sup>126</sup> The Peabody Freeze is a systemic attempt to drive the people from the fenceline to remove all obstacles of extraction.

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120 Linthicum Kate, "Trying to Rebuild after 40 Frozen Years," Los Angeles Times, November 5, 2009.

121 Ibid.

122 Commission on Human Rights: United Nations, "Commission on Human Rights Continues Indigenous Issues," The United Nations, <http://www.un.org/press/en/1997/19970407.hrcn786.html>.

123 Navajo elders describe surviving many deadlines for relocation in January public comments submitted to EPA.

124 Lacerenza.

125 Public comments submitted to EPA as part of NGS BART permit actions from Forgotten People's Program Director in January 2014.

126 See figures for a photo showing the hardship of residents who have to grade their own roads in order to keep supply routes passable.

### *Coal Slurry, Transmitting Extraction in the Laboratory of the Anthropocene:*

Amidst this genocidal story of forced relocation, the destruction of traditional ways of life, and denial of self-determination, is the story of coal and water extraction. Boyden helped Peabody Coal Company gain leases with both the Navajo Nation and Hopi Tribal council. These leases became what is today known as the mining complex at Black Mesa. Construction of the two coal mines: the Black Mesa Mine and the Kayenta Mine jeopardized life within the region for the residents who remained. While the Black Mesa Mine supplied coal for transport through the world's first and longest experimental coal slurry line, the Kayenta Mine transports coal on an electric railroad 85 miles to the 2250 MW Navajo Generating Station in Page, Arizona on Lake Powell near the Glen Canyon Dam.<sup>127</sup>

The stabilization of the urban sociotechnical controversy over energy, water, and pollution in the quest to provide electricity and water to a growing urban southwest outsourced pollution far away from the urban centers of the Southwest. The resolution of urban-environmental-energy controversies created new controversies along freshly created fencelines in an already deeply contested indigenous landscapes. Building the sociotechnical networks of power and water production simultaneously constructed fenceline communities at the heart of extraction where urban controversies over water and power were outsourced and externalized to rural areas.

Population growth was explosive around Phoenix and the City of Los Angeles. For example, the population of Maricopa County was 663,510 in 1960 and 3,945,000 in 2013 while Los Angeles County's population was 6,038,771 in 1960 and 9,818,605 in 2010 according to US Census data.<sup>128</sup> Population growth of 595% from 1960 to 2013 in the Phoenix area required huge supplies of energy and water. Providing water and electricity to these desert cities would take massive sociotechnical networks employing mega extraction technologies: dragline excavators, coal transport conveyors, huge boilers, turbines, and electric generators, coal storage and processing facilities, slurrification and de-slurrification stations.

As a result of planned growth enabled by the federal socialization of the costs for the largest dam projects in the world throughout the damming of the west in the 1930s, 1940s, 1950s, and 1960s, fossil fuel electrical generating projects experienced a boom time as construction of waterworks and coal generating stations became the norm to supply the growing cities.<sup>129</sup> The dams provided electricity and created reservoirs of water, two necessary components of modern, urban culture in the desert.

Coal-fueled generating stations were constructed by the use of economies of scale that fused the collaboration of capital from the Southwest's large power and water utility companies in

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127 There was considerable debate about using railroad system to transport coal from the Black Mesa Mine. See figures for photos of the complex.

128 See: California State Data Center's Historical Census Populations of Counties and Incorporated Cities in California, 1850–2010. California State Data Center, "Historical Census Populations of Counties and Incorporated Cities in California, 1850–2010," ed. Demographic Research Unit Department of Finance (Online2012). See: Maricopa Association of Governments, "Regional Fast Facts: Population and Growth," [https://www.azmag.gov/Fast\\_Facts/FFacts\\_PopAndGrowth.asp](https://www.azmag.gov/Fast_Facts/FFacts_PopAndGrowth.asp).

129 For a history of the socialization of water works in the southwest see: Marc Reisner, *Cadillac Desert : The American West and Its Disappearing Water*, Rev. and updated ed. (New York, N.Y., U.S.A.: Penguin Books, 1993).

novel organizational structures like the WEST (Western Energy Supply and Transmission) consortium.

The consortium pooled resources among many utilities to distribute shares of projects among many corporate, state and federal entities to reduce financial risk and generate economies of scale. The companies and agencies tasked to provide the benefits of socialized and subsidized water and power delivered by the Federal Government through the damming of the Colorado River included: Arizona Public Service Company, Arizona Power Authority, City of Anaheim, El Paso Electric Company, Department of Water and Power of the City of Los Angeles, Department of the Interior, Nevada Power Company, Public Service Company of New Mexico, Salt River Project, Southern California Edison Company, San Diego Gas and Electric Company, and Tucson Gas and Electric Company.

Later water projects like the Central Arizona Project (CAP) were built to transport Colorado River water from Lake Havasu across the State of Arizona, to Phoenix and Tucson. CAP required a huge amount of power to pump water over mountains and deserts. Coal fired power from the Navajo Generating Station continues to provide the power for the huge electrical pumps needed to transport enormous volumes of water uphill over hundreds of miles.

On Black Mesa, the WEST consortium decided that a railroad was the best means of transportation of coal from the Kayenta Mine to the Navajo Generating Station. A slurry line was chosen after careful deliberations that considered the use of a railroad to the Mojave Generating Station located hundreds of miles away in Nevada. WEST decided on the slurry line because it would be the most economical way to get the coal to the Mohave Generating Station and avoid the possibility of coal supply disruptions along a much longer railroad route should labor disputes occur.

Constructing the slurry line consisted of laying an 18” diameter pipeline from Black Mesa to Nevada. The slurry line travels across the Little Colorado River in Cameron, Arizona, traversing uphill southwest toward Flagstaff across the Mogollon Rim before descending to reach Laughlin, Nevada. The coal was mined and broken into very fine grains at the Black Mesa Mine complex.<sup>130</sup> The granulated and pulverized coal was mixed 50-50 with water and forced through the pipe for 285 miles. Water was extracted from the Navajo Aquifer from a series of wells without placing any additional strain on the overallocated Colorado River.

### ***Destabilization of the Navajo through Extraction:***

In January 2013 a team of three people departed on a voyage: a lawyer, a college drop-out, and I. Our mission was to journey to The Navajo Reservation in Arizona to assist a GIS mapping project to document the occupation and sacredness of the land with the help of longtime human rights activist Marsha Monestersky and other associates of Forgotten People.<sup>131</sup> As part of a legal

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130 See figures for pictures of the slurry complex at Black Mesa.

131 Forgotten People is an organization representing traditional Navajo in their struggle for water and land rights in the area known as the Bennett Freeze on Black Mesa. In 1974 the Navajo reservation was partitioned into Hopi Partitioned Land (HPL) and Navajo Partitioned Land (NPL) so that mining could continue without interference. This partitioning of the land was a strategy to pit the Navajo against the Hopi for the purposes of a smoke and mirrors tactic of distracting the traditional elders on both sides against the common enemy of the destruction of their cultures by the Peabody Western Coal Company. While the traditional Hopi Leaders and Navajo Leaders do not see any land dispute



research project we were working with traditional people to map land-use to show a federal judge how continued relocation and mining impacted fenceline residents. We collected evidence of land-use for submission to a Department of Interior Administrative Law Court as part of a case against Peabody's Kayenta Mine permit renewal.

The three of us left in haste in middle of the night to drive to Harrisburg, Pennsylvania. We flew from Harrisburg to Chicago and then to Phoenix. Throughout the flight I was stunned by the vastness of the landscape that has marked the national consciousness of the United States since its founding. Upon arriving in Phoenix, overtaken by the beauty, and seemingly barrenness of the landscape with giant Saguaro Cacti, I recalled images from Edward Abbey's *Desert Solitaire*. I understood this barrenness as a mirage, especially as I came to understand the peoples, places, and environments of the Colorado Plateau.

I would come back to visit the Navajo Nation in August of 2013. Vincent Kline, my longtime friend, and I left Blacksburg at around ten in the morning on hot, muggy August day. Our task, under direction of an attorney, was to take public comments and submit them to the EPA on permit actions related to the Navajo Generating Station and Best Available Retro-Fit Technology (BART) requirements. Tired from the previous night, unable to sleep because of a distinct feeling of anticipation, we drove non-stop 1500 miles to Denver. Embarking with little sleep on the longest drive of my life, I far surpassed the grueling miles of a trip to Quebec City Canada to Blacksburg, VA.

Having an efficient hybrid vehicle, with electric air condition, we departed from John's Camera Corner in Downtown Blacksburg in my father's Toyota Prius. Our plan was for Vincent to film and document the trip visually. We would be taking audio/visual public comments to submit to the EPA. Under guidance of our attorney, we sought to collect public statements on the EPA's Permit Renewal of the Navajo Generating Station (NGS), see if we could arrange for an interview with a medicine-man about fracking, and conduct community service work in whatever way we could to support the elders. Finally, we were to arrange to film the living conditions of residents who live in the Bennett Freeze area in order to raise money to rebuild and build new homes for a few of the many people that were forbidden to build, maintain, or repair any structure since 1974

The unfrozen Bennett Freeze of the western Navajo Nation continues to significantly impact residents. The freeze was driven by disputes over natural resources between the tribal councils and fear from Washington bureaucrats, unfamiliar with local politics and controversies, of an imminent range war. The freeze remains a structural feature to the impoverishment of entire generations of people despite it being lifted in 2009. I witnessed a destitute woman with many children in the midst of her one room house, constructed of scrap, discarded plywood, explain that she had to burn her outhouse down for heat in the winter when wood was scarce. Residents endure living conditions in temporary structures inadequate for the weather conditions of extreme heat and cold of the high desert. Conditions in the winter can easily entail 60 mph winds with temperatures easily below -15F at night. In some locations snowstorms cut supply lines off for days as dirt roads become impassible from mud, snow and ice.

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between them the tribal councils installed by the Bureau of Indian Affairs (BIA) maintain a land dispute. The consequences of this land dispute are wide with over 12,000 people being relocated from HPL since the freeze began.

The image of using the outhouse for warmth, sacrificing the toilet for heat, captures the dire conditions in the region in contrast to extraction of millions of tons of coal heating city homes. Yet this image is only one among many we heard describing the destitution, poverty, disease, and environmental disaster on the Navajo Nation as a result of years of government policy outlawing self-determination and self-sufficiency. In a land scarce of income, jobs are hard to find. Capitalist economic development entails natural resource extraction with limited support businesses like food and lodging. Only the bare necessities of employing institutions exist in urban settings of small reservation towns such as Tuba City and Kayenta. Tuba City is comprised of the barest networks of fast-food restaurants, motels, roadside jewelry and bead stands next to the modern newly constructed jail, the largest structure in the area.

The worst conditions we witnessed are on the fenceline of the active mining area. Fenceline homes are damaged from daily blasting from active mining operations near their homes.<sup>132</sup> Often, there are no fences separating their homes from large industrial extraction technologies of the draglines, coal transport trucks, and conveyor belts. Clouds of black smoke from coal seam fires, contaminated water, lack of electricity, privation of running water, and mined landscapes striped of the Juniper and Pinon trees that characterize the area, are the visual cues marking the experience of extraction on the fenceline. The scenery around the Black Mesa slurry unit is an industrial wasteland with people living amidst its ruins. In all senses of the word people confront an apocalyptic situation. The landscape's scars testify to The Navajo Nation and Hopi Tribal Council decisions to negotiate their status as mineral resource colonies during the Boyden years.

On the fenceline, conversations with local people and environmental justice activists centered on the large quantity of water pumped out of the Navajo aquifer leading to the depletion of surface wells and springs. Many well tanks are spray painted "Water is Life" or "Water is Sacred." In an arid region fenceline residents understand the value of water. Years of drought, climate change, and extraction continue to challenge scarce water resources.

Fenceline discourse underscore the immense scale of the slurry project and its effects upon the local population. Ironically, the slurry line was "developed with the environment in mind," says Peabody. In fact water "...won't come from the Colorado. Water in tremendous quantities is needed to transport the coal and Peabody is supply it from [5] wells, drilled on leased Indian lands."<sup>133</sup> Today, we bear witness to the consequences of this type of transportation. Fenceline residents work as water-haulers carrying water from the Kayenta Mine's two public water stations to people in need because their traditional springs have disappeared due to aquifer depletion.

Throughout our encounters we heard many first-hand accounts of the impacts of the slurry line on land, people, and the environment. These accounts provide valuable knowledge about the experience of extraction and the interaction of fenceline residents with extraction's impacts and risk. Residents on the fenceline have become experts in living with and amidst the slurry project from continued consequences of decisions made by WEST in the 1970s. Many residents became activists against Peabody by organizing themselves and working to educate others about the effects of mining on indigenous lands.

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132 See table of figures for photos of the mining area and fenceline.

133 Michael C. Chaplin, "Black Mesa Project Will Feed Southland's Hunger for Power," Los Angeles Times February 2, 1971.

Residents explained how the slurry project enframed many miles of the desert landscape through its path. Slurry technology brought relationships of extraction to the surrounding environment by disrupting the land and people. The line changed the landscape along its route in many ways. Signs were placed, blasting occurred, and the soil was disturbed, through the implementation of slurry. Impacts from the large project destabilized the region as construction of the corridor brought the line within range of people and animals of the many homesteads in its path. Many pipeline residents discussed ruptures over the years and how it would take days for repair crews to stop the bleeding of black noxious water on grazing lands nearby to homesteads. Animals would drink the contained water and perish. Fenceline communities' relationships with the landscape fundamentally changed through extraction.

The reliance on water to slurry coal as a viable means of transportation seems foreign in a desert environment with scarce water resources. Slurry lines require massive amounts of water to transport pulverized coal in an aqueous mixture. Accounts vary as to the exact amount of water extracted for slurrification. Water is continuing to be pumped for use at the Kayenta Mine from the same wells used for the slurry. Marsha Monestersky and others claim that over 30 billion gallons of water has been pumped from the underground aquifer on Black Mesa. We know even larger amounts of water were taken from the Navajo Aquifer. Peabody Western Coal Company was permitted to "... to pump nearly 5 cubic hectometers (4,000 acre-feet) of groundwater every year..." from the Navajo aquifer to transport coal.<sup>134</sup>

Proponents of the slurry line constructed it as an effective method of transporting coal where railway or truck transportation were constructed as impracticable. The project required immense water resources. Many Farms students explain:

Considering the length and size of the pipe and the volume of coal that is needed, this slurry line requires a great deal of water. To provide this water, Peabody Coal has drilled five deep wells at about two miles distance from each other. When the slurry line is operating, these wells will pump about 2,310 gallons of water per minute out of the Navajo sandstone, one of the sandstone layers which is buried deep under Black Mesa.<sup>135</sup>

The mass extraction of water depleted the aquifer throughout 34 years of operation. Due to geological conditions these wells pump water which cannot be recharged from the arid surface of Black Mesa. Many Farms explains, "...the wells are sealed down to the 2,000 foot level, which should mean they are effectively below the Mancos shale and therefore not connected with the upper water bearing strata."<sup>136</sup> Even though, theoretically, there is not any interaction between this deep water aquifer and the shallow wells and springs of the traditional residents, countless fenceline residents explained that after the construction of the mines their water sources have slowly dried up. Expert knowledge dictates that there is no interaction between shallow water, yet fenceline residents have experienced the opposite effect and tell of a slow drying out of the region that began with implementation of coal mining and slurry transportation.

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134 Britt Dveris, *Environmental Justice on Black Mesa: Balancing Energy Development with Traditional Cultural Values* (Arizona State University, 1999), 30.

135 Many Farms High School, 58.

136 Ibid. See: Donald L. Baars, *Navajo Country a Geology and Natural History of the Four Corners Region* (Albuquerque: University of New Mexico Press, 1995).

This deep Navajo aquifer water cannot be recharged from the surface of Black Mesa because of a layer of shale. In the age of the Anthropocene, a changing climate, the water in the Navajo aquifer is invaluable as surface water and rainfall diminish. The slurry line deprived fenceline residents of needed water resources to withstand and build resilience against climate change. These wells are still in use for the active Kayenta Mine. Coal mining requires intense water use, but local residents lack running water. Many residents will travel to the Peabody public water stations to fill 500 gallon tanks for use at their homesteads.<sup>137</sup> This water costs many times the amount of the water in the cities that their coal helps to deliver. Distant urban metropolises are provided resources from the extraction of the Mesa's water and coal. Despite furnishing cheap water and electricity, residents pay much more for water because of high transportation costs on unmaintained, ungraded roads.

As I became more aware of these details and furthered my research I came to understand the magnitude of slurry project and how it is one of the most controversial of socio-technical networks constructed in Northeast Arizona because of the sheer quantity of water required in a high-desert-arid climate. The southwest United States is experiencing one of the longest and most severe droughts since Europeans arrived. Many Farms explains, "Water is gold in the Southwest. The Navajos and Hopis are traditionally short of water."<sup>138</sup> Slurry methods require mixing water 50-50 with pulverized coal. As the world's largest slurry line 18" diameter pipeline spanned from Black Mesa to Bullhead City, Arizona, near the Nevada and California state lines, the use of indigenous water sources fueled the cheap electricity and water delivered to far away metropolises. Robert Rosenblatt summarizes the scale and size of construction of the project:

Starting the middle of this year [1970], production will accelerate. At least 117 million tons of coal will be pushed through the Black Mesa Pipeline over the next 35 years. Navajo and Hopi Indians get royalties on each ton...Coal slurry will enter the pipeline at the mine, 6,300 feet above sea level. The terrain and the line drop to 4,850 feet at Gray Mountain's pump station, soaring to 6,500 feet at the top of the mountain. The route slopes down over the Black Mountains, across the Colorado River and down to the generating plant, at Bullhead City Nevada, and a height of 700 feet.<sup>139</sup>

The size and length of the line significantly disrupted the landscape in order to construct it over rugged terrain. The project's copious groundwater consumption, a priceless non-renewable resource, produced resistance from environmentalists and the fenceline community beginning with the project's inception. Today, the defunct slurry line continues to shape the discourse about future prospects of mining practices in the public comments I heard throughout my trip.

After many negotiations, litigation, and public outreach, the water controversy surrounding the coal slurry line eventually led the EPA to revoke the Black Mesa Mine permit in 2005 on the grounds that Peabody was violating its water requirements listed in its operating permit. Consequently, dismantling of the Mohave Generating Station began in 2009, and the landmark smokestack was demolished on March 11, 2011.

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137 See table of figures for a photo of Peabody's public water station

138 Many Farms High School.

139 Robert A. Rosenblatt, "Pipeline Will Carry Liquid Coal to Fuel Massive Power Plant," Los Angeles Times 1970/02/10.

Numerous times Black Mesa residents explained how overjoyed they were that the slurry line is now defunct. However, like a ghost, the towering abandoned slurry complex reminds fenceline residents of the resource extraction burdens of a defunct project that continues to impact the region. We drove by the point of origin at Peabody Western Coal Company's now abandoned slurrification station with its rusty tanks and twisted metal conveyors towering over barren reclaimed mining land. The complex is still lit at night as a reminder to the people living within 100 yards of the fence of the grid electricity their land provided, but they still do not have.

The risk from slurrying coal is still being understood on the fenceline as residents face increasing pressure on the little water resources they have access to. The experimental nature of the project has fundamentally altered life on the fenceline as risk was outsourced from the cities to create the fenceline community. Residents continue to confront the slurry line's legacy through depleted water resources and damage to the land. Residents live in the shadow of the ruins of the defunct project amidst Peabody's freeze on construction and ongoing relocation attempts.<sup>140</sup>

### ***Re-Constructing Expertise of the Socio-Technical Network:***

I listened to many hours of people discussing in both Navajo and English the effects of the coal slurry line throughout my time on the reservation. Fenceline residents told histories of pipeline ruptures, BIA livestock confiscations, polluted water, coal dust, coal fires, smoke, sheep deaths, ammonium nitrate spills, water depletion, blasting, and other ailments to their traditional way of life. The risks, that the press emphasized needed to be avoided in the large cities, like Los Angeles, were reproduced inside the fenceline.

I found the official expert history of the coal slurry pipeline upon our return to Virginia. I began to ask questions about why such a project was seen to be feasible prior to and at the time of construction when today it seemed so reckless? What motivated the construction of the slurry line in a desert environment and its operation for decades? What logic was used to by its constructors to justify its construction and operation?

In the course of answering these questions I was deeply troubled. I found difficulty in reconciling the competing narratives of pipeline construction, operating experience, and expertise I encountered in official literature about the slurry line with the experience of what I had witnessed throughout my time on the western Navajo Reservation from accounts of fenceline experts.

A disjuncture between the corporate and regulatory published work on the slurry project and the first hand images of the devastation on the fenceline underlies the controversy of the slurry line. Discursive disjuncture between official accounts and the oral history of those that live around risky activities are found in many conflicting accounts of large scale sociotechnical systems that prioritize the subliminal appeals of the technology at the expense of those communities who disproportionately bear the costs and risk of disruptive industrial projects.<sup>141</sup>

This dissertation argues that contestations over whose expertise and knowledge counts in fenceline spaces is found in all fenceline sites that involve sociotechnical systems that laboratorize the fenceline through the production of risk. I was increasingly unable to reconcile the witnessed

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140 See figures for photos of the ruins.

141 University of Las Vegas Libraries, "Nevada Test Site Oral History Project," <http://digital.library.unlv.edu/ntsohp/>.

destruction evident throughout our trips on the reservations with the official narrative of pipeline construction and operating experience emanating from production and regulatory experts.

The cognitive dissonance between official expert narratives of construction and the lived fenceline experience underscores the fundamental blindness of regulatory and production expertise in understanding the risks of coal extraction on the fenceline at Black Mesa. I came to see these accounts as reinforcing regimes of colonialism in the Navajo Nation as discursive representations that recount the prowess of the history of the outsourcers of electricity and water production, but not the perspectives and voices of the fenceline residents where extraction occurred.

The official history of the slurry line is constructed through the perspective of operators, regulators, and stakeholders of water and electricity production. These accounts leave out visceral threats to Diné traditional ways of being. Instead, the history of the fenceline experts living alongside extraction is excluded from official accounts of the project. Diné expertise of the complexities of how to live in the arid region through animal husbandry and proper stewardship of the natural environment is excluded. There is no account that includes their experience of the devastation of the landscape from coal and water extraction. Instead slurry discourse emphasizes how mining will provide income and develop the region into the progress of modernity.

Expert accounts were developed through stakeholders' resources during construction and operation using narratives of progress, automation, the technological sublime. These accounts appeal to the prowess and scale of technoscientific artifacts to deliver resources to growing urban centers.<sup>142</sup> I began to understand the perpetual war perpetrated on native peoples in the United States in different images other than cowboys and Indians motifs portrayed by John Ford movies. Water, coal, ammonium nitrate, relocation, blasting, and draglines became the replacement images in my head: the tools of resource colonialism.

What colonizer needs reeducation when you got a coal mine and government authority to freeze maintenance, construction, and forcibly relocate people with official trespassing notices? Where was an accounting of fenceline knowledge of the living conditions in the Painted Desert and the challenges traditional people would face when their ancestral homelands were mined out using explosives, water extraction, and heavy equipment?

I answer these question by illustrating how the press discussed the history of the coal slurry line. These historical press publications serve as valuable indicators of how the project was discussed at the time. Why coal and then slurry according to traditional energy experts? In a 1971 article by Michael C. Chaplin from the *Los Angeles Times* entitled "Black Mesa Project will Feed Southland's Hunger for Power," Southern California's "insatiable appetite for electrical power has created a monster" is cited as the chief reason for the development coal and hence coal slurry.<sup>143</sup> According to this article recent blocks on new construction of power plants in the Los Angeles, because of smog concerns, made coal mining on the reservation a path of least resistance. Los Angeles County banned the construction of new coal fired power plants because of emissions risks.

The irony is that residents of Black Mesa would shoulder the costs of progressive environmental efforts to ban coal fired plants in Los Angeles. The irony was not so well laughed

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142 See: J. G. Monfort, July 1981, interview 30., J. D. Pitts and R. A. Hill, "Slurry Pipeline Technology an Update and Prospectus," in Sixth Interpipe Conference (Houston1978)., David E. Nye, *American Technological Sublime* (Cambridge, Mass: MIT Press, 1994).

143 Chaplin.

at on the Navajo Nation. Coal burning would be outsourced far from the cities to the detriment of indigenous people, a story familiar in environmental justice accounts of environmental racism and degradation around the planet.<sup>144</sup>

Environmentalists had successfully halted the further damming of the Colorado River and local fossil power proved to be ineffective because of regulations on the construction of new coal fired power plants. The solution to urban environmentalist successes against coal was for utilities to burn coal in monster boilers located in rural areas far away from the urban environmentalists. For example, there are seven large scale operating generating stations currently in operation either within or just on the boarder of the Navajo Nation: Coronado Generating station, Cholla Generating Station, Navajo Generating Station, Four Corners Power Plant, San Juan Generating Station, and Escalante Generating Station. These stations continue provide electricity for the Southwest's large urban cities.

Outsourcing of the pollution risks of largescale fossil fuel burning generating stations, while maximizing the benefits of cheap power, became the norm during the 1960s. The "interim" technical solution to the social problem of energy and pollution in the city recognized that "...modern living comes out of an electric wall plug."<sup>145</sup> Energy drives urban society. Chaplin understood the conflict between pollution risks and energy needs. He argued "...eventual answer may be nuclear power on a massive scale, but that's decades away... the stopgap measure seems to be coal---supplied to giant steam plants which generate electricity far from Los Angeles. The power is transmitted here to local utilities."<sup>146</sup>

Hailing the positive effects of coal, Chaplin argues, "Coal may be soot-producing, old fashioned fuel but it's still the greatest source of energy the United States---used to produce over half the electrical power generated."<sup>147</sup> Similarly, a 1969 *Los Angeles Times* article details how two generating station projects were in the works to fulfill the urban centers demand for power while outsourcing the effects. Ernest Schonberger states, "Coal, that SOOT-producing smog-abetting fuel which as besmirched many Eastern communities for decade, is a year away from being stoked into service to help meet the vast electrical power needs of Southern California. But southland residents won't have to gripe about the grime, nor about coal combustion adding to the smog."<sup>148</sup> Chaplin discusses how WEST coordinated the resources to build a generating station at Four Corners, in Fruitland, New Mexico and another at Mohave, Nevada (The coal slurry fueled plant). WEST proposed others including a never realized giant 5 million kilowatt facility on the Kaiparowits Plateau in southern Utah. The outsourcing of the effects is cited as a reason for Los Angeles' residents to breathe easy.<sup>149</sup> Fenceline residents of Black Mesa were not included, nor

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144 See the works of Robert D. Bullard, *Unequal Protection: Environmental Justice and Communities of Color* (San Francisco: Sierra Club Books, 1994)., Robert Todd Perdue and Gregory Pavela, "Addictive Economies and Coal Dependency: Methods of Extraction and Socioeconomic Outcomes in West Virginia, 1997-2009," *Organization & Environment* 25, no. 4 (2012)., Michele Morrone and Geoffrey L. Buckley, *Mountains of Injustice: Social and Environmental Justice in Appalachia*, vol. 1 (Athens: Ohio University Press, 2011)., Enei Begaye, "The Black Mesa Controversy," *Cultural Survival Quarterly* 29, no. 4 (2006).

145 Chaplin.

146 Ibid. Nuclear Power is also cited as a viable electricity generating technology in Ernest A. Schonberger, "Southland to Utilize Coal Power by 1969," *Los Angeles Times*, 1968/07/14.

147 Chaplin, "Black Mesa Project Will Feed Southland's Hunger for Power."

148 Schonberger, "Southland to Utilize Coal Power by 1969."

149 According to Phillip Fradkin of the LA Times 7 coal-gasification plants were planned for the Reservation to supply natural gas to California. Fenceline community members opposed the project. According to Leroy Aarons of

mentioned other than in vague terms about job creation and economic benefits from the industrialization of their land.

This discourse of outsourcing is central to the story of The Mohave Generating Station and the coal slurry line. What is omitted in these accounts is a discussion of risk to the communities on the fence line of the plants and mines. Outsourcing characterizes the fundamental architecture of the slurry line. Energy companies outsourced production of water and resources to the Navajo and Hopi Tribes, and the pollution of burning coal to remote Nevada, Arizona and New Mexico. Coal mining was outsourced far away, the power plants were located a little closer, but still far enough away to keep the pollution away from the centers of population. Large scale transmission lines were built from the power plants to centers of power consumption. Often the transmission towers have been referred to as White Man's Gods by the indigenous people who live in their shadows.

The slurry stakeholders were part of WEST and included: Southern California Edison (Manager) with a 56.0% stake, Los Angeles Department of Water and Power 20%, Salt River Project 10.00%, Nevada Power Company 14.00%.<sup>150</sup> These institutions came together to share the cost and output of the Mohave Generating Station. Partnership through WEST proved innovative as the utilities appealed to the economics of scale and pooling resources in investment and operation allowing for huge volumes of coal to be used in gigantic boilers.<sup>151</sup> The power companies would share their risk, while outsourcing energy production to MGS using coal sources from Black Mesa. This arrangement achieved a temporary resolution of an urban controversy regarding three major issues, which according to Schonberger, challenged the population in the urban cities: water, electricity, radiation.<sup>152</sup> However, this consensus was fragile as coal fueled generating stations require copious amounts of water for cooling and steam generation for the turbines. The use of enormous coal fired power plants would stress water supplies in the future and create concerns about pollution far away in the form of acid rain and the release of the greenhouse gas carbon dioxide.

Coal power requires a huge magnitude of water to produce, transport, and burn. The political economy of water was crucial to the expansion of the coal burning generating stations. As Schonberger explains, that "Mohave does not sit on a coal bed, however, it was selected partly because it is on the Colorado River and a mere 275 miles from Black Mesa bituminous coal bed in Arizona. A slurry pipeline from Black mesa to Mohave will be used for transport," while water for cooling could be used from the Colorado.<sup>153</sup>

Instead of using a railroad, which would place cooling water burdens on the Colorado River, slurry technology would be championed by coal power proponents because it would allow

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the Washington post a total of 6 massive coal plants were planned. See: Philip Fradkin, "Gas-from-Coal Plants Will Change Life-Style of Navajos," Los Angeles Times 1973. Leroy Aarons, F., "Southwest Colossus: Power and Pollution: Southwest Plants: Needs vs. Pollution," The Washington Post, Times Herald (1959-1973) 1971.

150 Martin Farris and David Shrock, Transportation Innovations in Arizona [Black Mesa Pipeline and the Automated Lake Powell Railroad for the Movement of Coal], vol. 21, Arizona Business (Arizona State University College of Business Administration, Bureau of Business and Economic Research, 1974), 21:13.

151 Ibid., 21:12.

152 Schonberger. There was fear about the risks of huge nuclear plants in the seismically active region of California. Environmentalists challenged the safety of building more plants in this region due to fears about radiation contamination and release.

153 Ibid.



MGS to use the water recovered from the slurry for cooling and electricity generating purposes placing no strain on the Colorado River's contested resources. Colorado River water allocation was carved up through the 1922 Colorado River Compact between the Upper and Lower basin states of the Colorado River basin. Colorado River water was needed for irrigation and drinking purposes of the large cities. Not using Colorado River water for power production helped sell the project to urban environmentalists.

A Southern California Edison executive also cited diversification as another reason to develop coal power. Massive coal generating plants were as a case of "... protection for the public. We would not want to be completely reliant on any one type of plant in the event that something should happen."<sup>154</sup> Security is fundamental to the discourse used by expert proponents to convince the public to accept large coal power water intensive technoscientific architecture. Security for the Navajo and Hopi was promised in the form of job creation and the creation of a market economy on the reservation to move the tribes into modernity. Environmental security in the form of long term concerns about water availability on Black Mesa or air quality around the plants and mines is not discussed. Instead, fenceline security is reduced to wages and narratives of job creation.

Hydropower is out of the question because "economical dam sites—either those close-in or the distant with enough water to justify the outlay for long distance transmission to Los Angeles—have already been taken."<sup>155</sup> The combination of Los Angeles residents' unwillingness to tolerate more smog, arguments regarding diversification, water availability, and large available quantities of coal, a rise in nuclear fuel prices, perceptions of nuclear safety, and escalating demand for electricity pushed utilities to search for new sources of "cheap" energy.<sup>156</sup> The cheapness of coal was defined in terms of the urban environment, not the traditional people living on the land around the fenceline of where the mining, slurry line, and electricity generation would take place.

Coal would be vigorously pursued for the next 40 years in the southwest, laboratorizing the environment in the process. The era of the Anthropocene is defined through the ability of humans to change Earth's geology including the chemical composition of the atmosphere. Coal use is part of the chemical alteration of the chemistry of the atmosphere via vast burning for power generation. Understanding the Anthropocene reopens questions and pressures on human activities at the nexus of energy, water, and land use that were achieved through WEST's stabilization of controversies over water, power, and environment in urban landscapes in the early 1970s.

The decision to use coal was championed as resolving a power, water and environmental controversy. Gladwin Hill of the New York Times describes the controversy during construction of the slurry line in July 1970: "Here in southern tip of the Nevada desert, a brand new black and white stripped smokestack juts 500 feet above the sagebrush. It symbolizes an important aspect of a nationwide struggle---Power vs. Environment."<sup>157</sup> The fact that energy and the environment is opposed in the coal discourse indicates an early awareness of the controversy at stake. However, if at the time, Hill had consulted with the fenceline community members, facing relocation for the

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154 Ibid.

155 Ibid.

156 Ibid. I put cheap in scare quotes because the true costs would be externalized onto America's indigenous peoples and those living far away from the urban metropolises. For Fenceline communities what is often described as cheap for those benefiting from the activity is actually quite expensive. This is not to say that some fenceline residents do not benefit from a risky activity, but that

157 Gladwin Hill, "Struggle in the Desert: Power vs. Environment," New York Times 1970.

project, he would have understood that coal was also a struggle over the survival of indigenous cultures. Instead omission of fenceline knowledge from the narrative characterizes the major discursive justifications of the project in public discourse.

The discursive framework championing the narratives of production and regulatory expertise appealed to the resolution of urban controversies. This discourse ignored the problem of risk for mining communities and knowledge about coal mining impacts on the fenceline community at Black Mesa through the risks of operation of the slurry complex. The contributions of an ecology that looked at survival and adaptation holistically was omitted in official discourse. Permits were issued and coal use as a resolution to urban environmental problems created drastic consequences for those people on the reservations who lived close to the land and relied on it for survival. The discourse of job creation for the fenceline ignored the risk to way of life on the fenceline.<sup>158</sup> Leroy Aarons wrote, “As the impact of the energy network came to be understood, it gave birth to and nurtured a new kind of ecology movement that has begun to catch up to the power makers. But it is late.”<sup>159</sup> The ecology movement that Aarons mentions already existed among the traditional Navajo people who opposed mining and the slurry complex from the beginning.

Gladwin Hill’s argument about power vs. the environment only tells half the story. No mention was made of the effects on the fenceline from the mines. The modern discourse of conflict between the environment and electricity is not a new controversy, but was only mobilized in context to urban socioenvironments, not on the fenceline of the extraction zone. In 1970 Clark County, where MGS is located, imposed new air pollution laws squeezing the 190 million dollar complex.<sup>160</sup> Hill argues, “All over the country, the pressure for power-plant development, as demand for electricity grows, is running into environmental obstacles—air pollution, thermal pollution, and fears of radiation hazards.”<sup>161</sup>

As a non-nuclear facility, Mohave ‘temporary resolved’ two of these issues because it discharged no boiler-cooling water.<sup>162</sup> Air pollution would be more difficult to overcome. Navajo coal was solicited because of its low sulfur content (lower sulfur-oxide emissions); however, Mohave consumed 6 tons of coal per minute and produced 20 tons of fly ash per hour without scrubbing technology.<sup>163</sup> Even with a 97% soot-removal efficiency 1 ton of fly ash could billow into the sky per hour according to Hill. The regulations proposed by Clark County would limit fly ash to ½ ton per hour which assumes a 98.6% efficiency of soot removal.<sup>164</sup> A technological fix would be necessary to address air pollution. However, technological fixes at the power plant did nothing to remedy the violence of coal production on the fenceline residents of the Black Mesa mining area. Today, residents continue to experience unregulated emissions from coal fires caused by blasting in the pit at the Kayenta Mine.<sup>165</sup>

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158 See: William E. Blundell, "Ecological Shootout at Black Mesa," Wall Street Journal 1971., Leroy Aarons, F., "Mesa Mines: Hopis Profit at a Price: Hopis Torn by Choice of Tradition vs. Jobs," The Washington Post, Times Herald (1959-1973) 1971.

159 "Southwest Colossus: Power and Pollution: Southwest Plants: Needs vs. Pollution."

160 Hill.

161 Ibid.

162 Ibid. I use scare quotes to indicate that the notion of a resolution is anything but reality if you go discuss the slurry line with traditional elders of Big Mountain, Black Mesa.

163 Ibid.

164 Ibid.

165 See table of figures for pictures of the fenceline space.

In addition to emissions at the mine, the risk of water extraction from a non-renewable aquifer in the desert was also ignored. To transport coal to Mohave Generating Station, Hill argues, that slurry line transpiration would be the cheapest available method of moving vast quantities of coal. Mohave was “a \$190 million array of structures as tall as a 20-story building and more complex than a Cape Kennedy launching platform.”<sup>166</sup> The immense scale and size of the operation relied upon many new innovations in materials processing. The slurry line was one such innovation. The pipeline line developed as an alternative transportation to rail.<sup>167</sup> David Shrock and Martin Farris in *Transportation Innovations in Arizona* appeal to a long history of transportation innovations to construct a narrative of progress representing coal slurry transportation at the apex of modern transportation achievement and innovation. They explain:

Transportation has always been an important part of the Arizona economy. From the first steamboats on the Colorado, pack trains into mining camps, and Butterfield stages across the barren desert to modern railroads, highways, airways, and pipelines, transportation availability or its lack has been a pivotal force in the economic development of the area.<sup>168</sup>

Constructing the importance of such innovation, experts appeal to a teleological history of technological improvement. Proponents folded slurry line development into a history of transportation beginning with of steamboat development culminating with modern coal slurry line technology and coal burning architecture.

Slurry lines do not have local network taps that characterize other large scale transportation infrastructure like river ports, train stations, and interstate highway exits. Today, experimental natural gas pipeline proponents continue to justify pipelines in terms of the economic benefits, yet they lack the local taps that characterize traditional transportation networks which help to stimulate the local economy along traditional transportation networks.<sup>169</sup>

Automation forms another justification to champion and construct the closure of slurry technology to resolve urban controversy. Using automation as saving on costs is a justification Martin and Shrock emphasize, “Arizona is now using new automated techniques that can reduce the cost of moving needed raw materials from remote areas to points of consumption.”<sup>170</sup> Automation, as a virtue of slurry technology, is constructed to resolve any potential supply disruptions which could develop as a result of conflict between management and labor. Shrock and Farris explain:

The importance of labor to transportation is vividly illustrated whenever a labor-management dispute erupts into a service stoppage; the dependence of transportation on manpower is quickly obvious. In contrast, the new coal carrying transportation projects in

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166 Farris and Shrock, 21, 11. Some discrepancy exists in the literature with regards to the price of the facility. Chaplin in “Black Mesa Project Will Feed Southland’s Hunger for Power,” states that \$207 million dollar price tag with over \$300 million invested in the mining operation on Black Mesa by Peabody Western Coal Company.”

167 Trains continued to move the majority of American coal.

168 Farris and Shrock, 21, 11.

169 Mande Young, “Thousands of Jobs May Be in Pipeline,” *The Herald-Dispatch*, [http://www.herald-dispatch.com/news/thousands-of-jobs-may-be-in-pipeline/article\\_b5222355-405f-5acc-a70b-dc2b3fbc62d7.html](http://www.herald-dispatch.com/news/thousands-of-jobs-may-be-in-pipeline/article_b5222355-405f-5acc-a70b-dc2b3fbc62d7.html).

170 Farris and Shrock, 21, 11.

Arizona have a minimum of manpower requirements; obviously this means that the amount of capital utilized is very large.<sup>171</sup>

The appeal to automation to resolve capital/labor disputes is an age old story dating back to the Luddites, Taylor and Ford.<sup>172</sup> Celebrating the mythology of automation offered a way of technologically mitigating any future labor disputes. While most transportation facilities in the United States have substantial ratios of manpower to capital, a slurry line has minimum labor requirements. The slurry line offered security to the owners of capital who faced an environment of well-organized trade unions in the United States at the time of construction. This is an example of embedding labor politics into sociotechnical architecture, similar to Langdon Winner's argument in "Do artifacts have politics."<sup>173</sup> Railways require intense manpower compared to slurry lines. A railway was considered when MGS was planned, but abandoned in favor for slurry pipeline technology.

By building a slurry line operators ensured fenceline residents could not jeopardize the supply of coal by blockading a railway or launching a strike. The construction of a rail line would have required construction of a line from the mine site to the existing Santa Fe track, running through Flagstaff, and an additional spur to generating station.<sup>174</sup> This would have required constructing 140 miles of new track and a total mine to mouth distance of 420 miles.<sup>175</sup> Railway executives directly fought the slurry line because "they see pipelines as a threat to the financial well-being—some even say survival—of the profitable Western railroads."<sup>176</sup> Executives waged "...an intensive campaign against the pipeline legislation."<sup>177</sup> However, their resistance was limited and could not counter the technological sublime appeal of the slurry line for utilities looking to minimize risks from labor disputes.

Martin and Shrock appeal to how the success of the slurry line will have a "significant long-range effect on the economic availability of resources in the United States."<sup>178</sup> They argue how the slurry line will affect the longevity of the resource extraction. By appealing to progressive innovation, automation, lower costs, and the future long-term longevity of natural resource extraction, slurry technology was celebrated as a technological sublime innovation.

The slurry pipeline built the fenceline into its architecture. Water extraction is the very root of slurry technology. Using slurry technology necessitated the continual extraction of valuable fenceline water in Black Mesa. Using Black Mesa's water insulated the Mojave Generating Station's construction from the political controversy of Colorado River water allocation. Building labor and water politics into the design of a system helped experts to plan for future possible disruptions of labor by designing a system that was resistant to labor perturbations and Colorado River water politics.

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171 Ibid., 21:12.

172 David A. Hounshell, *From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States*, vol. 4.;4; (Baltimore: Johns Hopkins University Press, 1984).

173 Winner Langdon, "Do Artifacts Have Politics?," *Daedalus* 109, no. 1 (1980).

174 Farris and Shrock, 21, 13.

175 Ibid.

176 Newton W. Lamson, "Railways Fight Coal Slurry Pipeline," *New York Times*, 1976/01/04/ 1976.

177 Ibid.

178 Farris and Shrock, 21, 11.

## ***Conclusion:***

The Navajo Nation is experiment in extraction. Laboratorization of the socioenvironment through extraction is now being brought to new communities across the United States through implementation of fracking pipelines that seek to export energy riches to coastal cities for export into the world energy market. Black Mesa's experience is a harbinger of things to come for fenceline residents in the Marcellus shale and other new fracking sites who face new contestations over the environment, fossil fuel extraction, and the demands of the world energy market.

Those living in the Black Mesa sacrifice zone face relocation, coal pit fires, surface water depletion, pollution, invasive species introduction, ammonium nitrate spills, livestock deaths, and harassment by BIA officials through forced relocation. Sacrifice of Black Mesa through extraction is an extension of the United States' historic colonial project to wipe off the native peoples from the American continent. Fenceline residents experienced the outsourcing of major conflicts over urban controversies, yet their experiences were never solicited.

However, Black Mesa's survivors continue to discuss their suffering. Many became activist-experts on the frontlines of fossil fuel infrastructure development. Their fenceline expertise is an important domain of knowledge in understanding how fossil fuel infrastructure projects have unforeseen and unknown risks and consequences especially in context to fossil fuel pipelines.

The utilization of slurry technology subjugated the expertise of fenceline residents and denied them epistemological relevance vis-à-vis the WEST consortium's official line of reasoning and expertise. Denial of epistemological equality and the subjugation of fenceline knowledge resulted in empirical and substantial genocidal effects in the extraction zone; evident for anyone visiting the region. The risks associated for fenceline residents were not included in any official line of reasoning other than the vague mentions of pollution from the generating stations. Diné expertise on the fenceline was excluded in any official account of the slurry project. Instead the project was framed in terms of job creation, modernization, and propelling pastoral "natives" into the future.

The technological sublime appeal of slurrification by technical experts attempted to gloss over the systemic negative effects and risk to local communities on the fenceline of coal extraction. The paradigm of fossil fuel production is beginning to see fissures as 21st century sciences are now understanding the ramifications of coal extraction on both the planet and fenceline communities within extraction zones. Helped by documentation of the Anthropocene and developments in the epigenetics of trauma, we increasingly understand the negative effects of fossil fuel development and extraction. However, new regions are at the center of the current contestations over fracked gas pipeline infrastructure, such as Appalachia.

Pipeline proponents, allied through the WEST consortium, championed the innovation of the coal slurry pipeline. Yet, the slurry line's success would prove to be premature. Symbiotic issues of aquifer depletion, air quality, indigenous land and human rights violations, and anthropogenic climate change have all reignited dormant and festering controversies that were never laid to rest by the temporary stabilization of urban contestations over power, water, and pollution.

In the Anthropocene power and the environment are again at the center of a major socio-technical controversy. Today, the southwest is facing augmented threats of water shortages through prolonged and historic drought conditions. The concerns of environmentalists in Los Angeles County in the 1960s have now become globalized. Coal temporarily resolved urban environmental controversies over the battle of energy and water. Today new fractures in the controversy are evident in the form of escalating temperatures, more intense wildfires, drought, species loss, and climate change in the sensitive and fragile areas of the desert where even a small change in precipitation fundamentally alters the socioenvironment.<sup>179</sup>

By examining primary source material on the public discourse of the construction of the coal slurry line one would have the impression that the controversies over power, water, and the environment were resolved. However, through technoscience, we understand the perturbation of the atmosphere's chemistry via massive fossil fuel projects. As a marker of time, the era of the Anthropocene signals the reigniting of dormant energy/environment/human-health controversies across the planet that were produced on the fenceline of Black Mesa at the time of construction.

This case raises important questions about how can we reformulate our understanding of risk to empower fenceline knowledge and expertise to resist the marginalization of communities of people who live in the fenceline areas? How does the concept of the fenceline allow for a stronger objective account of large sociotechnical systems in context to environmental justice? Instead of surrendering cognitive sovereignty to the bequest of technoscientific development, how can local fenceline knowledge and expertise be included to help mitigate the risk from the unforeseen consequences of sociotechnical development?

These questions are very important for the future. The Desert Southwest is facing prolonged drought, worsening air quality from fracking, continued coal dependence, climate change, and an uncertain future as a result of the mass-population growth straining water resources in an arid environment. The large scale Colorado River dams are facing supply constraints and there is even talk in the press about the possibility of removing the Glen Canyon Dam.<sup>180</sup> I do not pretend I can answer all above questions, but I offer a few historical glimpses of how decisions taken in 1960s impact life in the 2010s. The story about the coal slurry line suggests that all of these questions should or ought to inform regulatory policy approaches to the construction of new extraction systems in any landscape. As the case of the Colorado River Dams illustrate, just because water is abundant today, does not mean it will be tomorrow! Uncertainty within the laboratory experiment of the Anthropocene abounds.

This story of the coal slurry line told a story of production expertise and socioenvironmental ruin by mobilizing the importance of including fenceline knowledge and expertise within the laborized sites of risky industrial operations. In public discourse championing the use of the slurry line the knowledge and expertise of operators and regulators is privileged in contrast to the missing voices of the fenceline. Public discourse extols the project

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179 Diane Hope, "Earth Notes: Photographing Climate Change," <http://knau.org/post/earth-notes-photographing-climate-change#stream/0>; EMERY COWANS, "Bleak Future for Warming Forest," Arizona Daily Sun, [http://azdailysun.com/news/local/bleak-future-for-warming-forest/article\\_21fe9e42-7585-5a84-b4d2-31d6c65c3ee7.html](http://azdailysun.com/news/local/bleak-future-for-warming-forest/article_21fe9e42-7585-5a84-b4d2-31d6c65c3ee7.html).

180 For an excellent history of the great water projects and the future of the west vis-à-vis water see: Reisner.

while excluding the knowledge claims and perspectives of fenceline residents. Without an accounting of the voices on the fenceline, the story of risk from the slurry pipeline is incomplete.

The weak objectivity found in newspaper articles, at the time of construction of the slurry line, contrasts to the accounts that were delivered as public comments to the Environmental Protection Agency on the Navajo Generating Station's 2014 Best Available Retro-fit Technology (BART) requirements. The comments were submitted by postal mail on a DVD sent in Los Angeles on January 5, 2014 to US EPA's San Francisco office.

Environmental justice (EJ) advisement is now found in in the protocol of regulatory agencies. The inclusion of EJ advisement makes the case that we are in the midst of adopting an alternative paradigm to regulatory policy which aspires to include the concerns and experience of fenceline residents. In spite of good efforts, fenceline knowledge and expertise continues to be excluded from official risk planning and assessment.<sup>181</sup>

Signals of change are in the air as the Kayenta Mine and its generating station, the Navajo Generating Station (NGS), is coming under similar scrutiny that faced Mohave Generating Station prior to its demolition. Kayenta mining operations are undergoing similar scrutiny that the slurry project came under during the early 2000s. Water constraints on Lake Powell, the source of cooling water for NGS, pollution control technology standards, climate change, and the decline of the coal market are forcing discussions over the future of the Navajo Generating Station and mine.

More and more people outside of the reservation know of the mineral resources controversy on Black Mesa. The struggle on the reservation for survival, due to the extraction of huge amounts of resources for distant urban cities, has received renewed national media coverage.<sup>182</sup> There is now general consensus to move away from coal for power generations, yet some in rural communities grasp to keep using the dirty fuel because of the economic benefits it provides. Peabody Coal filed for bankruptcy on April 13, 2016. Change may be in the air! Today, fenceline activists in the mining area continue to work to regain the loss of cognitive sovereignty through the mobilization of discourses of fenceline observation, experience, knowledge, and expertise.

Symbolic of the festering controversy was the demolition of the Mojave Generating Station on March 11, 2011. The razing of the plant points to future struggles over WEST's active coal burning stations in the Southwest. Their future, like new construction of nuclear power technology following the Three Mile Island disaster, are in flux. The experience of residents on Black Mesa, living in the midst of a coal disaster, exerted considerable pressure on the controversy that the slurry line was intended to fix. Instead of fixing problems, the slurry line relocated them by producing the contested space of the Black Mesa fenceline.

Risk to traditional ways of life in a desert environment was not included in the technological sublime narratives of the fossil fuel proponents and their experts. Instead risk was defined according to threats to slurry advocates' interests. Risk were ignored in context to the indigenous who rely upon the water sources that would be depleted through the pumping of vast amounts of water, the spilling of toxins near sheep camps, and the dirty air from coal fires ignited by blasting in the pit.

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181 United States Environmental Protection Agency, "Environmental Justice," United States Environmental Protection Agency, <https://www.epa.gov/environmentaljustice>.

182 Vice News, "Cursed by Coal: Mining the Navajo Nation," (Vice News, 2015).

With Peabody filing for bankruptcy on April 13, 2016 the future vitality of the Kayenta Mine and Navajo Generating Station, 15 miles from the Grand Canyon, is again cast in doubt as the environmental and human health risk impacts continue to be quantified. Risk is now being understood differently, through conceptualizations enabled by the Anthropocene, even though residents of Black Mesa still suffer from the high costs of coal extraction in their community for the benefit of powering distant water projects like the Central Arizona Project. Some community members benefit from the jobs the Kayenta Mine provides, however, bankruptcy is now threatening those jobs with little to take their place in a contaminated, sacrificed, mined-out, landscape.

New domains of research are emerging which shed insight onto the long-term effects of living in a coal extraction fenceline. Further study of the relationships between exposure, disease, and genetic inheritance are emerging sciences combining epidemiology and toxicology to investigate the relationship between disease, exposure, and inheritance from coal mining activities.<sup>183</sup> The promises of these emerging sciences will have profound impacts on understanding the transmission of fenceline risk through the human genome.<sup>184</sup> The laboratorization of the fenceline is revealing new information about the effects of extraction on fenceline residents. Fenceline residents have become experts in the experiment of extraction.

Surveying the background controversy that informed the sublime technological expert narratives of the Black Mesa coal slurry line reveals the systematic discounting of Navajo and Hopi fenceline expertise of the risks faced in their communities. Denial of the experience of fenceline residents' risks has wrought havoc on the traditional Diné way of life. In 2016, residents continue to face livestock impoundments, forced relocation, and pollution on the fenceline by Peabody's Freeze.

Reflexively, I do not pretend this is a definitive account. The Black Mesa coal slurry line was one of the largest socio-technoscientific networks of energy production ever built in the southwest, thus telling the story is extremely complex. I acknowledge the limitations in this work: I have not presented all frameworks of risk and actors. Instead, I attempt to show how combining STS research with autoethnography constitutes a potential approach to complexity on both the micro and macro-level to remain grounded in my legal research experience.

Second, by not mobilizing ethnographic evidence to discuss Navajo perspectives regarding the slurry-line or coal mining I did not specify the different approaches to natural knowledge in the same location based on location within the network. I did not present knowledge accounts from geological studies of the Black Mesa mining site or surveys of the pipeline route or those of the elders on the fenceline. These accounts are invaluable for understanding the construction of knowledge and expertise in the region by contrasting epistemologically different ways of understanding the space on the fenceline. Further work should be undertaken in these domains to contrast indigenous ways of understanding the region to the enframing process of technoscience vis-à-vis the natural world from coal mining.

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183 Randy L. Jirtle and Frederick L. Tyson, *Environmental Epigenomics in Health and Disease: Epigenetics and Disease Origins*, vol. 1 (New York; Heidelberg: Springer, 2013).

184 Katharina Gapp et al., "Implication of Sperm RNAs in Transgenerational Inheritance of the Effects of Early Trauma in Mice," *Nature Neuroscience* 17, no. 5 (2014).



Third, the specific accounts of individuals who worked for the utilities, Peabody, construction companies, the Mohave Generating Station, or manufacturing facilities was ignored. This was beyond the scope of this project. I understand the importance and necessity of locating specific people as actors and their understanding of the slurry line. I generalized immensely over specifics, but intertwined, contestations with regards to land, water, and air use in the urban areas to which MGS electricity was destined for. I did this in order to tell a story about how coal slurry was rationalized in the public discourse using narratives found in the press.

Finally, I am aware that investigating the contemporary controversy that led to the closure of the Mohave Generating Station and subsequently the Black Mesa pipeline and mine is an important part of this story, yet this would have distracted my inquiry from the historical approach examining the public discourse of pipeline construction.

Instead I focused on the emergence of the slurry technology in the southwest United States in order to situate the importance of fenceline experience of risk. Investigating the shutdown of the pipeline, more directly, would help to illustrate the valuable role of fenceline knowledge and expertise in advocating for change. The point of this chapter was to show how fenceline knowledge and experience was not included in the initial construction of the artifact to show how residents experienced risks that the project was intended to mitigate in the urban cities.

This chapter demonstrates the need for inquiry on the sociotechnical systems of resource extraction on indigenous lands of the Southwest United States. The slurry line is a huge sociotechnical system, so complex to span 285 miles, involve many people, jurisdictions, competing actors and expertise. It is a crucial site in the history sociotechnical systems of water and power production of the Desert Southwest. The evidence surveyed in context to my legal research demonstrates the variety of competing narratives in context to the social construction of the slurry line. Many different histories and perspectives exist for one artifact, yet I specifically examine how fenceline knowledge and experience were excluded from official accounts to illustrate how risk was conceptualized in popular discourse.

The slurry line's meaning is constructed by diverse networks of interactions between actors on both the micro and macro-level. I focused on the contrast between encounters throughout legal research on the fenceline and the official discourse supporting the construction of the slurry line. I brought attention to the disjuncture between official accounts and fenceline experience to help establish the categories of fenceline knowledge and expertise as useful to strengthening our objectivity of the social and environmental contestations of large scale sociotechnical systems.

The fenceline is an important concept in the understanding of how sociotechnical systems impact those in closest proximity to the risks of large scale industrial systems. Examining the public discourse on the decision to implement slurry technology shows how the experience and knowledge of those who live on the fenceline was excluded while simultaneously illustrating the contradictory discourse that emphasized how minimizing risk for urban cities. This exclusion is crucial to the project's official narrative. The exclusion of fenceline knowledge and expertise from official accounts, in context to large scale industrial facilities, is a recurring theme throughout this dissertation. This chapter helps to establish key concepts of fenceline analysis in chapter 3 on open burning at Radford Arsenal.

### **Chapter 3: The Reciprocity of Denial: Risk on The Fenceline at Radford Army Ammunition Plant's Hazardous Waste Open Burning Ground**

#### ***Introduction: Situating RAAP: Secrecy and Ignorance:***

In contrast to the landscape of Black Mesa there is a lack of vast open space in the Appalachian Mountains. Small hills, mountains, stream valleys, and sharp ridges cut off the view of the land around Radford Army Ammunition Plant (RAAP) unless one has direct access to the cliff top of the canyon to the New River. Colloquially known as the Radford Arsenal, the plant profoundly shapes the region's socioeconomic history. RAAP is the largest polluter in Virginia since 2003 according to EPA's Toxic Release Inventory.<sup>185</sup>

Topographic features like the sharp ridges of the river valley, trees, and other geographic features contribute to a lack of direct line of sight; obscuring visibility of the facility. One cannot gaze out and see the expanse of the operation found in Black Mesa. Radford is not in big sky country. Reduced visibility obscures perception and knowledge of the facility. The facility is very difficult to see unless on remote private land with owner permission. Instead space is organized by the hilly, holler, topography of the region.

The combination of geography, topography, and geology, shrouds the facility in secrecy from the peering gaze of the public. Unless from the air it is very difficult to see the sheer size of the facility. Satellite pictures cannot capture the size of the place and the scale of operations. Often students at the nearby university, Virginia Tech, who spend at least 4 years in the area, are unaware of the Radford Arsenal's existence.

This chapter interrogates the question of how risk from the practice of open burning hazardous waste explosives is constructed at Radford Arsenal through expert discourses that sustain secrecy and ignorance at the facility to strengthen our objectivity of the contestations on the fenceline.<sup>186</sup> Open burning of hazardous waste is the practice of placing toxic material on an outdoor pan, pouring diesel fuel on the material, and igniting it. I argue that including fenceline

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185 United States Environmental Protection Agency, "Toxics Release Inventory Program". See table of figures for specific TRI information.

186 The contestation over the meaning of "hazardous waste site" can be thoroughly deconstructed. However, for the sake of this dissertation I take assume that the Radford Arsenal is a hazardous waste site based on its unique RCRA permit. The US EPA, and Virginia Department of Environmental Quality rate the plant as the largest releaser of pollutants in the state of Virginia. Just as debates exist over whether a chemical is toxic or not, debates over the severity of hazardous waste sites obfuscate the fact that people live next to them and experience a variety of negative and positive interactions at the site. Often times we do not know the severity of a site until many years later as our instrumentation, pollutant understanding, or perception changes through advances in medical knowledge and environmental knowledge. Just as glasses enable sharper resolution of objects, advances in knowledge enable a sharper focus and resolution of the risk of pollutants and their threats. Arguments that Radford Arsenal is not a SUPERFUND site and therefore is less dangerous do not help to remedy concerns of fenceline residents who happen to live next to the plant and experience negatives. The classification of hazardous waste is a fluid. Changing science on toxicity is subject to many of the same arguments about the principle of reciprocity in which science both shapes and is shaped by society found in Science and Technology Studies theory. For example, perchlorate is not regulated in drinking water in Virginia, but is known to be toxic to humans. Perchlorate is regulated in drinking water in California and Massachusetts. The condition of a chemical's regulatory status does not necessarily mean it is not toxic. Please see the works of Thomas Hughes, Harry Collins, and Trevor Pinch on social construction of technology. See: Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, Mass: MIT Press, 1987).

knowledge and expertise into the consideration in the construction of risk at RAAP minimizes risks.

In the historically isolated Appalachian corridor inquiry and information about the facility's emissions and the consequences of the effects of munitions making is obscured through 75 years of secrecy and sociotechnical momentum of munitions manufacture. As an insider, growing up on the fenceline, I demonstrate scholar-activist fenceline knowledge and expertise to articulate how RAAP's production and regulatory experts in Southwest Virginia's New River Valley create secrecy, cloudiness of facts, and systemic denial of fenceline concerns in light of ever growing fenceline knowledge of the risk associated with open burning.

Virginia Tech's Kentland Farm occupies land adjacent to the river downstream of the Radford Arsenal and is a fenceline resident.<sup>187</sup> The Virginia Department of Environmental Quality identified the area containing Kentland Farm within the site-receptor open burning fallout zone of the 2005 C2HMHill Human Health Risk Assessment, yet failed to not mention that the area is a site of commercial food production.

In 2009 Virginia Tech began producing food at the farm on the fenceline of Virginia's largest polluter; a relatively new phenomenon in the long history of Radford's propellant operations. Fellow academic researchers in Dairy Science and the College of Agriculture and Life Sciences have refused to discuss the facility with myself. Little dialogue about the fenceline proximity of the farm exists. Inquiry concerning the farm is referred to the public relations department at Virginia Tech known as University Relations. The unknown effects of open burning toxic munitions waste travels all the way up through the halls of the knowledge producing institution of Virginia Tech. Virginia Tech's main campus is downwind of the facility. The Agency for Toxic Substances and Disease Registry acknowledges in their 2015 assessment a lack of air data in regard to their assessment.<sup>188</sup>

As a concerned fenceline resident, I requested a dialogue and was allowed to speak with University Relations. However, after repeated attempts the College Agriculture and Life Sciences has refused to hold any meaningful scientific or technical discussion about concerns expressed by myself and other community members. No discussion of the fenceline location and implications of the farm next to the largest polluter in Virginia, with documented groundwater contamination has occurred with fellow academic researchers who operate the farm.<sup>189</sup>

Officials from University Relations conducted a limited dialogue with the researcher about what sorts of testing is occurring at the farm for legacy contamination and contemporary emissions. After fenceline concern officials conducted a one-time test of irrigation wells. Low levels of perchlorate, dioxin/furan compounds, chromium and barium were found in irrigation wells in May of 2016.<sup>190</sup> However, no further testing is planned in spite of known groundwater contamination under the facility. This decision not to test follows a year of pressure from myself and other concerned citizens organized as the Environmental Patriots of the New River Valley to test

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187 See the table of figures for specific location maps and proximity to nearby communities.

188 Agency for Toxic Substances and Disease Registry, 1. Soil, surface water, groundwater, and air are all connected through precipitation.

the community's concern and recognizes the lack of air sampling results as a data gap in the assessment of community exposures."

189 Mike Gangloff, "Well Tests Find More Chemical Evidence," *The Roanoke Times*, May 5, 2016.

190 Draper Aden Associates, "Kentland Farm Water Well Sampling and Analysis," (2016).

irrigation wells at the fenceline farm. Yet, no regular testing is planned in the future for specific chemicals related to explosives manufacturing. In spite of continued unknowns, limited offsite testing has occurred along the fenceline. However, with more chemical detections no regular offsite monitoring occurs even as discharge permits allow for continued releases into the air and water using a risk discourse of safety and tolerable limits even as the specifics of the hydrogeology of the karst topography of the region remain unknown.

The deliberate lack of data is a component of the construction of ignorance confronted in many fenceline areas.<sup>191</sup> Willful ignorance is constructed through the deliberate lack of information on the fenceline. The unwillingness to examine unknowns through rigorous inquiry and the devotion of resources and time is a condition of ignorance. Fenceline sites experience conditions of ignorance influenced by the deployment of resources to generate knowledge of and about risk. The epistemology of ignorance grew out of the study of ignorance in systematic racism. The study of the relationship between ignorance and the epistemology of race contributes significant theory to the mechanisms and relationships of ignorance in the production of systems of inequality.<sup>192</sup>

Ignorance sustains inequality by aiding the construction of narratives of safety and the lack of inequality on the fenceline.<sup>193</sup> Ignorance of conditions within the fenceline space crucially supports the creation of discourses of safety and risk mitigation that strengthen producer and operator expert claims. For example, at Radford, there is a deliberate non-existence of knowledge of the impacts of open burning by the poverty of air data. Lack of air data produces ignorance. Residents can see and smell the emissions, yet producers and regulators claim safety and control of risks in discourses supporting the operation. Furthermore, there is the lack of karst topography mapping despite known groundwater contamination at the Radford site.

Scarcity of data creates conditions of momentum for regulatory approval and reliance on open burning as an acceptable method of hazardous waste treatment because there is no knowledge or data to challenge expertise claiming the safety of open burning. Ignorance of open burning ground emissions, constructed by the lack of direct testing, allows regulatory experts and producers to champion computer simulations and abstract risk assessments that promise safe management of risk without any real world verification or falsification of these models. Ignorance of data and lack of knowledge reduces accountability. By not asking specific questions there is no way to verify or falsify the concerns and claims of fenceline residents who experience and observe the pollution.

The Black Mesa case illustrated how fenceline knowledge was discounted at the expense of a carefully crafted discourse of the prowess of slurry technology. Discounting fenceline knowledge through the refusal to inquire and answer questions creates cloudiness in our ability to understand risk on the fenceline. Charles Mills in *White Ignorance* explains:

The idea of group-based cognitive handicap is not an alien one to the radical tradition, if not normally couched in terms of “ignorance.” Indeed, it is, on the contrary, a

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191 Lerner.

192 Sullivan and Tuana. Charles W. Mills, *The Racial Contract* (Ithaca, N.Y: Cornell University Press, 1997).

193 Linda Martin Alcoff explains, “One of the key features of oppressive societies is that they do not acknowledge themselves as oppressive. Therefore, in any given oppressive society, there is a dominant view about the general nature of the society that represents its particular forms of inequality and exploitation as basically just and fair, or at least the best of all possible worlds,” in Sullivan and Tuana, 48.

straightforward corollary of standpoint theory: if one group is privileged, after all, it must be by comparison with another group that is handicapped.<sup>194</sup>

Handicapping fenceline knowledge through constructed ignorance helps to perpetuate risky activities. In and around the Radford site there are many examples of deliberate ignorance of regulatory and production experts who refuse to study certain phenomena. Mobilization of unknowns or lack of knowledge helps to discount fenceline expertise.

The lack of air quality monitors and testing, which could assist fenceline residents' understand of the risks from open burning, allows regulators to claim the safety of open burning. Tests and hydrological studies could examine offsite contamination to provide more clarity on the situation. For example, tests exist to determine the source of the perchlorate in the irrigation wells at Kentland farm, yet they are not conducted.<sup>195</sup>

The choice to reduce ignorance of socioenvironmental issues of a polluting activity is a deliberate and strategic choice. Without tests officials can claim the perchlorate came from fertilizer. This is a red herring argument mobilized to delegitimize concerns about the facility. Tests are not conducted as their results could jeopardize official expert claims. Production and regulatory expert knowledge is privileged at the expense of fenceline knowledge of smells and plume observations of toxic material from the open burning ground. The lack of clarity of information inhibits changes. Ignorance of risk helps to maintain the status quo of the facility.

Willful ignorance at Radford operates in many domains of concern about the facility, including a lack of study of the hydrogeological and atmospheric conditions. The refusal to study ground water and open burning around on the fenceline precludes the evolution of knowledge and stymies knowledge of the relationships between the facility and the fenceline. Mills states:

Suppose, for example, that a particular true scientific generalization about human beings, P, would be easily discoverable in a society were it not for widespread white racism, and that with additional research in the appropriate areas, P could be shown to have further implications, Q, and beyond that, R. Or, suppose that the practical application of P in medicine would have had as a spin-off empirical findings p1, p2, p3.<sup>196</sup> (21)

In the case of not having the air data, P, we cannot proceed to Q or beyond in order to assess and form knowledge about how open burning is interacting with the fenceline. Fenceline residents cannot receive answers about health questions of open burning because of the deliberate lack of formal knowledge of the effect of open burning. There has never been a health study conducted on open burning or perchlorate in the water at the Radford site despite the laboratorized landscape.

The lack of air data ensures reliance on abstract risk assessments grounded in little empirical study. These assessments promise safety, yet ignore the reality of who is being effected by open burning because there is no verification of the models using real-world conditions. In polluting sites mobilization of tolerable risk involves the strategic deployment of knowledge and

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194 Ibid., 15.

195 See: John Karl Böhlke et al., "Perchlorate Isotope Forensics," *Analytical chemistry* 77, no. 23 (2005)., "Reston Stable Isotope Laboratory (RSIL)," United States Geological Survey, <http://isotopes.usgs.gov/>.

196 Sullivan and Tuana, 21.

expertise in simultaneous conjunction with a deployed distribution of unknowns and lack of knowledge through the intentional construction of ignorance.

Deliberate ignorance at the Radford site intersects with the dynamics of secrecy of an active military industrial facility. Secrecy obscures inquiry into the toxic legacy of the site. Secrecy makes knowledge of risk from operations increasingly difficult to understand and determine. Secrecy reduces information and harms dialogue between the facility and marginalized communities that live around the fenceline.

Secrecy and ignorance produce many unknowns and uncertainty. Fenceline residents do not have access to the computer inventory system cataloging the material that is transformed and dispersed at the open burning ground because of corporate and national security secrecy. Residents cannot know the specific products which are being produced and open burned next to their homes due to classifications further inhibiting citizen science.

Entire sections of pages in a 2011 Multi-Media Inspections report and the EPA's 2014 National Enforcement Investigations Inspection Follow-up report are redacted.<sup>197</sup> Secrecy, ignorance, and obfuscation in the inquiry of the socioenvironmental effects of munitions open burning mystifies questions concerning knowledge of the facility's socioenvironmental impacts. The interface between politics of risk and knowledge is mediated by mechanisms of secrecy and ignorance through the strategic construction of the politics of risk and knowledge across complex networks of specializations of epistemic communities operating at the Radford site.

Secrecy, willful ignorance, status as a large employer multigenerational employer, organizational, and technological momentum all ground relations of power and knowledge to produce fenceline inequality. Excluding fenceline expertise and outside scientific knowledge of the toxicity of munitions from risk assessments undermines objectivity in the regulatory oversight of complex sociotechnical processes of munitions production and waste disposal through open burning.

Lack of publically available knowledge through monitoring and data collection of soil, air and water quality around the fenceline, delisting the facility from the National Priorities List (SUPERFUND), and long lack of broad community understanding of the risk posed by Radford Army Ammunition Plant are many of the competing reasons why open burning of toxic hazardous waste continues in September of 2016 when alternative technologies are proven and existence.

According to the EPA's National Investigations Enforcement Center's 1987 Updated Multi-Media Priority Ranking of Selected Federal Facilities for EPA REIGION 3 published in August 1987, Radford was rated the third most prioritized facility in need of remedial attention in the region.<sup>198</sup> This was ranked one position ahead of the Aberdeen Proving Ground, a vast chemical

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197 Armando Bustamante, Jessica Duggan, "Multimedia Compliance Investigation," ed. Office of Enforcement and Compliance Assurance (Denver Colorado: National Enforcement Investigations Center, December 2014). United States Environmental Protection Agency, "Multi-Media Inspection Report US Army Radford Army Ammunition Plant (RFAAP)," ed. United States Environmental Protection Agency (United States Environmental Protection Agency, 2011). See the table of figures section for an example of redaction found in these inspections. Despite no enforcement action on either inspection, a local activist was sent a letter from EPA which stated that these inspections would not be talked about with the outside parties including members of congress, the public and the media.

198 Eugene Lubieniecki and Joel Mattern, "Updated Multi-Media Priority Ranking of Selected Federal Facilities: Region 3," ed. Office of Enforcement and Compliance Monitoring (Denver Colorado: United States Environmental Protection Agency, August, 1987).

weapons legacy research, development, and storage site located in Maryland with deep ties to industrial/university partnerships like MIT's Division of Industrial Cooperation and Research (DICR).<sup>199</sup> Such a ranking provides context to the hazardous nature of the facility when early assessments and rankings were being conducted. Only the Letterkenny Army Depot and the Norfolk Naval Shipyard ranked higher in Mid-Atlantic's EPA Region 3.<sup>200</sup> Radford has consistently scored among the highest emitters of toxins on the EPA's Toxic Release Inventory in the nation since the escalation of the wars after September 11, 2001.<sup>201</sup>

In spite of the strategic construction of ignorance and secrecy by regulatory and production experts, fenceline observations and accounts document plumes moving over the community and smells associated with emissions from RAAP.<sup>202</sup> These fenceline accounts form crucial nodes of expertise on the interaction of the largest polluter in Virginia and the surrounding community. They strengthen our social understanding of risk. Fenceline knowledge compensates for the condition of ignorance and secrecy constructed by the deliberate lack and distribution of official data. Fenceline expertise catalogues the experience of living next to the facility, helping to fill in the gaps of knowledge created through willful ignorance and secrecy.

I examine the lack of a technical fix by analyzing risk assessments pointing to unknown repercussions of the operation of open burning hazardous waste munitions when alternative treatment technologies exist. This chapter provides context for the juxtaposition of robust public participation in adjudicating a decision to open burn that occurred in 2015 at Camp Minden. The final case of the trifecta of this dissertation examines how EPA's Region 6 utilized a citizens' dialogue to find alternatives to safely dispose of improperly stored M6 explosives. By implementing an alternative, EPA region 6 implicitly admitted open burning is not safe for fenceline residents.<sup>203</sup>

To reveal the dynamics of secrecy and ignorance that operate at RAAP's fenceline, I rely upon, emails, phone call records, video recordings of public meetings, and publically available documents to build an argument about risk and public participation engaged over the contestations of the practice of open burning hazardous waste. Embedded within this account is a reflexive research model of autoethnographic/scholar-activist inquiry. Reflexively, I illustrate the difficulties of a research agenda with many powerful stakeholders including the public university downwind of the burning ground.

I embed identity challenges that confront the scholar-activist position of a graduate student earning a degree from a university who occupies fenceline property. I am insider who grew up on Radford's fenceline. Throughout 4 years of activist engagement I filed Freedom of Information Act (FOIA) requests, attended public meetings, documented public meetings, sent activist letters to regulatory agencies demanding information, discussed the facility with anyone who would listen, co-organized community meetings, co-organized protests/demonstrations and helped in

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199 David Kaiser, *Becoming Mit: Moments of Decision* (Cambridge, Mass: MIT Press, 2010).

200 See Page 2 of NEIC 1987, updated multi-media priority ranking of selected Federal Facilities in Region 3.

201 See the toxic release inventory at: <http://www.epa.gov/toxics-release-inventory-tri-program> See the table of figures for a snippet into the facility's ranking..

202 See the table of figures section.

203 See: Mike Ludwig, "Why Is the US Military Still Burning Its Explosive Waste in the Open Air?," Truthout, <http://www.truth-out.org/news/item/34477-why-is-the-us-military-still-burning-its-explosive-waste-in-the-open-air>; Daniel Ross, "Toxic and Deadly, the Human and Environmental Toll of Open Burning," Truthout, <http://www.truth-out.org/news/item/36783-toxic-and-deadly-the-human-and-environmental-toll-of-open-burning>.

community outreach working with members of the arsenal watchdog group the Environmental Patriots of the New River Valley (EPNRV).

Events at Camp Minden to deploy alternatives to open burning, in conjunction with the work of the Environmental Patriots of the New River Valley, signals that change may be in the air. Lieutenant Colonel Alicia Masson indicated in May of 2016 that money is allocated to design and build a new Energetic Waste Incinerator (EWI) committing to the goal of handling 100% of all material currently being sent to the open burning ground. However, the facility is continuing to seek renewal of its expired open burning ground permit.

Recent media coverage of the story of Radford's open burning ground is in the national press along with other communities who live next to open burning sites.<sup>204</sup> The facility was recently mentioned in a letter from American Chemical Society's letter delivered to the Department of Defense and Environmental Protection Agency in July of 2016 questioning why open burning is still being used despite proven alternatives.<sup>205</sup>

As a scholar-activist, I have sought to increase our objectivity over the environmental and social effects of risk from the Radford Facility. However, there is no plan to add some of the explosive chemicals in the ground water under Radford Arsenal to the Virginia Household Drinking Water Testing program although many residents could potentially be effected in Montgomery, Pulaski, and Giles Counties. Little dialogue has occurred regarding environmental concerns brought by myself to the institution's academic branch operating Kentland Farm.<sup>206</sup> Virginia Tech did test for perchlorate at Kentland Farm, finding low levels, but at the highest level offsite in the three known examples of offsite testing for perchlorate. While the low result is good news there are now more questions than answers. The permit for open burning at Radford Arsenal is still going through a process renewal despite being expired since October 2015.

I tell the struggle of identity for a researcher, who is also a fenceline resident, acting with multiple competing interests and interactions around the Radford site, including the university in which this dissertation was conducted. This chapter serves dual purposes. First, I continue with themes developed in the previous chapters by looking at similar interplays of risk and environmental justice in a fenceline community around a large scale industrial activity to illustrate how fenceline knowledge and expertise are valuable in order to strengthen our objectivity of these contested sites. Second, I suggest a method of conduct for STS scholars concerned with fenceline facilities, giving insight into some of the strategies, challenges, and difficulties of conducting scholar-activist research on an active military facility with ties to the university that one is obtaining a degree from.

I tell a story of fenceline activism vis-à-vis Radford Arsenal producers and environmental regulators. STS's scholar-activist tradition, fused with insights in indigenous critical theory and risk studies, enables a stronger research praxis that can document, articulate, and elucidate fundamental inadequacies of the epistemologically dominant expert risk paradigm that functions

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204 Rex Springston, "Permit for Army Plant near Radford to Burn Explosive Waste Is up for Renewal," in *Richmond Times-Dispatch* (Richmond June 14, 2015). Andrea Brunais, "Permit Renewal Raises Questions for Radford Arsenal," *Appalachian Voices*, <http://appvoices.org/2015/06/15/sparking-a-controversy/>.

205 The law, 40 CFR 265.38, governing open burning, implies that when other modes of treatment exist open burning cannot be used.

206 Virginia Tech police asked if I was a threat to the University for discussing lead exposure and violence on social media. A lot of residents of our region have grown up downwind of a site where open burning of lead has occurred.



to keep fence-line community members uninformed and in denial about the toxicity and danger of open burning.<sup>207</sup>

This account of RAAP relies upon the STS's long interdisciplinary history in the study of large scale socio-technical systems. At Radford my personal experience in environmental justice sought to understand the social situatedness of risk, ignorance, and secrecy in context to the politics of fence-line knowledge. I situate this work in the domain of critical technology studies and history of technology work that founded STS as a field of study when the Frankfurt School was coalescing. Unlike many nuclear weapon sites, like the Hanford Complex, the Radford facility is still in production, continuing to produce conventional weapons ordnance that is deployed wherever the US military operates. The story of open burning at Radford Arsenal shows that secrecy is very much alive at defense installations.

As a scholar-activist, I understood that fence-line expert knowledge creation requires an understanding of how knowledge and its dissemination have favored sociotechnical interests in society. David Nye, Brian Wynne, Thomas Hughes, Valerie Kuletz, Langdon Winner, Herbert Marcuse, Kate Brown, and Michele Gerber offer fundamental insights into large scale socio-technical systems. Sites of nuclear weapons production and risk have seen significant contributions of research from those engaged in STS. These accounts show how STS literature has focused on military industrial locations by exploring cold war secrecy and the effects of these facilities on the landscape and people.

At Radford there is still a lack of available research outside of official government documents. STS inquiry concerning the controversies of knowledge and expertise at active nuclear-military-industrial facilities by Hugh Gusterson and Valerie Kuletz is the particular trajectory of research I ground this chapter in. This work continues a long tradition of research developed by Thomas Hughes on momentum of socio-technical networks developed by the US Federal Government.<sup>208</sup>

Kuletz and Gusterson use first-person inquiry on nuclear facilities to tell a story of the militarization of the southwest and its impacts. Their autoethnographic accounts form critical STS studies on major nuclear facilities and weapons facilities. Gusterson's *Nuclear Rites: A Weapons Laboratory at the End of the Cold War* documents the operation of secrecy at Lawrence Livermore National Laboratory. This work is invaluable and had a profound impact on the questions and decisions I made in the conduct of this research.<sup>209</sup> Kuletz's *The Tainted Desert* examines the militarized landscape of her childhood showing how STS can utilize an autoethnographic approach to pursue research on militarized landscapes. Both authors contribute crucial insights into arenas

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207 See paper discussing cancer mortality risk from long-term exposure to particulate matter 2.5 (PM 2.5). Chit Ming Wong et al., "Cancer Mortality Risks from Long-Term Exposure to Ambient Fine Particle," *Cancer epidemiology, biomarkers & prevention* : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology 25, no. 5 (2016).

208 Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983). "Technological Momentum in History: Hydrogenation in Germany 1898-1933," *Past & Present*, no. 44 (1969).

209 Hugh Gusterson, *Nuclear Rites : A Weapons Laboratory at the End of the Cold War* (Berkeley: University of California Press, 1996).

of secrecy and the United States' military operations. Their scholarship helped frame the intellectual trajectory of this work.<sup>210</sup>

Reading the accounts of Kuletz and Gusterson together with experiences on the Navajo Nation would challenge the internal narrative of safety, and lens, through which I understood the community in which I grew up. My identity would change to seek to better understand the fenceline of the New River Valley. Similar to the experiences of Valerie Kuletz, I came to understand the landscape along the New River as militarized, toxic, risky, and polluted. Experiences and solidarity with Diné fenceline residents helped me to interrogate my own identity and the narratives I told myself about the fenceline.

In the Desert Southwest, research continues to examine uncertainty about the long-term consequences of coal use and uranium mining in the four corners region through new understandings in epigenetic, heredity, and congenital effects of toxic conditions.<sup>211</sup> Little research of the sort is available at Radford or other conventional weapons sites like the Holston Army Ammunition Plant in Kingsport Tennessee.<sup>212</sup> These facilities, despite open burning permits, documented pollution, and releases of toxic substances into the fenceline community have little scholarly research dedicated to understanding their complexities. Instead, these spaces marginalize knowledge of their risks on the fenceline. I develop deeper objectivity of the contestations of risk to activate understandings through fenceline knowledge and expertise in pursuit of environmental justice.

I include an autoethnographic voice to bring personal experience to the account as a scholar-activist. The process of obtaining information took many years of dedication and persistent follow-up with officials, who often ignore emails or phone calls. Information about secret facilities is difficult to obtain. I encountered numerous complications navigating secrecy, redacted reports, officials who ignored requests for information, missing information on the web, different web-pages, disappearing news coverage, changing newspaper headlines, and in most cases, a lack of response.<sup>213</sup>

Information that is currently available consists of accounts from the institution and reports obtainable through the Freedom of Information Act (FOIA) process that are heavily redacted, and in most cases never answered. Challenging FOIA denials in court requires significant money and resources. Inquiry into an active military industrial site necessitates innovative tactics, visual sociology, and generation of primary sources through activist research to account for the lack of information and publically available information on active military sites.

The only scholarly work on Radford Arsenal is Mary Lalone's, *The Radford Arsenal: Impacts and Cultural Change in an Appalachian Region: Impacts and Cultural Change in an Appalachian Region*. She uses socio-cultural-historical methods to situate the facility historically. Her study deploys a narrative of urbanization and cultural change, studying economic change in the region using worker oral history. This chapter follows in the footsteps of Lalone. I attempt to broaden the scholarly history of the facility by focusing on the contentious open burning ground

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210 Kuletz.

211 Katia Kvitko et al., "Susceptibility to DNA Damage in Workers Occupationally Exposed to Pesticides, to Tannery Chemicals and to Coal Dust During Mining," *Genetics and Molecular Biology* 35, no. 4 (2012).

212 Like Radford Arsenal, the Holston Army Ammunition Plant is also contracted by BAE Systems

213 See table of figures for examples of missing information.

through publically available accounts.<sup>214</sup> No scholarship examines public participation, emissions, and risk in context to Radford. This work synthesizes micro, macro, and meso-levels of analysis of a complex ordnance producing facility at the center of United States' military power. I socially situate the practice of open burning at Radford Arsenal.<sup>215</sup>

Lalone focused on the urbanization of the region through the construction of RAAP in the backwoods agricultural region of rural Appalachia during and after World War 2. Her oral history is a powerful documentation of the facility that at the time received no scholarly attention. Lalone's account does not illustrate the complexity of the region prior to industrialization including relationships of change brought by the civil war and the genocide of Native Americans. Instead the account reads as a teleological history of the New River Valley region emerging into the light of modernity through urbanization created by RAAP's construction and operation.

Lalone's description presents Radford through the dominant historical discourse of economic change in the region. Her story reports a teleological emergence of an industrial-manufacturing economy taking the place of rural agriculture and mineral resource extraction that had long characterized the dominate forms of value-added economic activity in the New River Valley region. Her account of the arsenal takes little interest into the facility's environmental impact. Despite these inadequacies Lalone's case is valuable and provides significant context to the history and emergence of RAAP as a sociotechnical system. I broaden her work by examining contestations over RAAP's open burning ground. I adopt a normative research goal by prioritizing fenceline knowledge and environmental justice to discuss RAAP's environmental politics.

Conventional ordnance production continues to be the bedrock of United States' military power. Secrecy at active facilities constitutes one of the problems with conducting research on RAAP. There is a practically no academic research on active ordnance complexes. Secrecy and the toxic nature of explosives production following the escalation of the wars after 9/11 have contributed to a situation of unknowns-unknowns for fenceline residents around large munitions facilities.

Production and regulatory expertise create a logic of safety and controlled management in context to the willful lack of investigation of fenceline concerns. A carefully crafted expert discourse assures members of the public that the pollution from a facility is safe. Some community members who publically questioned the facility have faced questions to their integrity, knowledge or physiological state during heated meetings in which experts and members of the Department of Environmental Quality, BAE Systems, and The Joint Munitions Command reassure the public of

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214 Mary B. LaLone et al., *The Radford Arsenal : Impacts and Cultural Change in an Appalachian Region* (Radford, VA: Brightside Press, 2003).

215 For examples of studies that merge analysis of the micro, meso, and macro in context to technology, society, production and the environment see: Bijker, Hughes, and Pinch; David E. Nye, *Electrifying America: Social Meanings of a New Technology, 1880-1940* (Cambridge, Mass: MIT Press, 1990); Kuletz; Michele Stenehjem Gerber, *On the Home Front : The Cold War Legacy of the Hanford Nuclear Site*, 3rd ed. (Lincoln: University of Nebraska Press, 2007); Doug Brugge and Rob Goble, "The History of Uranium Mining and the Navajo People," *American Journal of Public Health* 92, no. 9 (2002); William R. Freudenburg, "Addictive Economies: Extractive Industries and Vulnerable Localities in a Changing World Economy," *Rural Sociology* 57, no. 3 (1992).

careful management and safety practices<sup>216</sup> Despite these safety assurance, RAAP is one of the riskiest sites for cancer hazard in the nation.<sup>217</sup>

By cataloguing the toxic legacy munitions making I build an account that furthers our understanding of what is at stake on the fenceline in context to risk politics. The experimental undertaking of large scale technology necessitates long-term research as knowledge evolves about the risks from production. I continue the interdisciplinary commitments of STS by examining how risk is shaped and shaped by society, science and technology in context to open burning at Radford Army Ammunition Plant.

### ***The Politics of Knowledge and Risk on the Fenceline: Black Mesa Informs RAAP:***

From experiences on the reservation, I came to understand my identity as a fenceline resident of RAAP. I grew up ½ mile North-North-East of the fenceline of Radford Arsenal. Without experiences with the Navajo and their struggle for environmental justice in Black Mesa, I never would have formulated questions to investigate the Radford Arsenal as a matter of environmental justice as a fenceline resident who grew up in the shadows of the plant.

Traveling back from the reservation, I observed similar interactions between power, expertise, risk, pollution, toxicity, and inequality present on the Radford Arsenal fenceline. Why was very little environmental concern about the facility during my fenceline experience as a child, teenager, and adult? In the year of my birth the facility was initially ranked so high in need remediation and posing dangers to public health?<sup>218</sup> Why was community organization lacking despite the rankings of the facility and the existence of a hazardous waste open burning ground?

Asking these questions brought me to taking on the role of an activist. Benefiting from the observation and lived experience on the reservation, this research grew from the shared experiences with residents of Black Mesa. Seeing how in Southern California sociotechnical fixes produced new problems far from the places that they were designed to benefit, experiences on the mesa illustrated key interactions between technology, risk, humans, and the environment on the fenceline. The organization and methods deployed by activists in Black Mesa profoundly impacted my scholar-activist approach.

In contrast to Black Mesa, little remanence of Native American culture remains in the area surrounding RAAP. There is no reservation nearby. I could not consult tribal elders about changes among the people and environment in the New River Valley as a result of RAAP's industrialization. I had to rely on my own knowledge of living on the fenceline to frame open burning as experienced by someone who is a fenceline resident.

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216 Many exchanges have occurred between members of the public and officials in which the residents are described as not knowledgeable, not normal, or in some capacity unable to reason the complexity at stake when one lives next to a hazardous waste open burning site.

217 See RSEI figures.

218 2016 has seen considerable movement by the community to address Radford Arsenal's pollution as EPNRV efforts to raise awareness of the issue in the community have finally succeeded in gaining some community interest. Ms. Bledsoe has worked in pursuit of Environmental Justice on the fenceline of Radford Arsenal as a community activist since 2008 .2016 has seen considerable momentum for exposure and public discussion of the issues at Radford. There is very little discussion of the facility outside of the channels established by the work of Environmental Patriots of the New River Valley. The reach of this group is growing steadily in light of a focus brought on the facility through this research and exposure of pollution and developments at Camp Minden.

There is a deficit of indigenous culture in the New River Valley. This is a fundamental weakness for community members concerned with the effects of risk from sociotechnical activities in the region as we have no historical cultural connection to the land. There is no oral history long told, on which to rely, passed down from indigenous people in the NRV about the Radford site. Only the dominant historical narrative of settler colonial progress exists, no better symbolized than by Virginia Tech's *Invent the Future* motto.

In telling of the history of the Black Mesa coal slurry pipeline I focused on the dynamics of a recognized national sacrifice zone. A 'sacrifice zone' is equally applied to Appalachian coal region, petro-chemical complexes, nuclear, and extraction regions across the country by environmental justice scholars.<sup>219</sup> The sociotechnical history of coal slurry and the urban controversy that propelled its construction illustrated a story of expertise, planning, and uneven risk analysis in context to the discounting of fenceline expertise.

The sacrifice of fenceline knowledge mirrors the sacrifice of place, a recurring theme inside sacrifice zones. Sacrifice zones are enabled by inequalities of power and the devaluation and exclusion of fenceline knowledge. National sacrifice of the Black Mesa residents' environment occurs through the detrimental treatment of indigenous peoples where the sociotechnical artifact of extraction is constructed. Residents shared narratives of uneven risk in context to the rich energy resources being consumed in large urban metropolises. Understanding suffering from fenceline risk, this chapter builds on Black Mesa to offer a critique of the open burning technology while focusing on another micro-case of my fenceline experience.

As an attorney's paralegal I saw how politics of risk mediates the relationships between producers, regulators, and fenceline residents. Public comments on the Navajo Generating Station's BART requirements tell a story of environmental dislocation.<sup>220</sup> Experts justified their slurry project in terms of the subliminal appeal of new, autonomous technology, in order to mitigate risk for urban consumers of water and power. Slurry mitigated the risk of potential labor perturbations of the coal supply and the championing of "clean" energy for decades to come while threatening Black Mesa social and environmental sovereignty.<sup>221</sup>

The slurry case illustrates how experts mobilized knowledge and discourse to advocate for the construction of the slurry pipeline without considering fenceline expertise on the local environment. These narratives emphasized maximizing benefits for urban communities at the determinant and risk to rural fenceline inhabitants through a narrative of job creation. In Black Mesa sacrifice of the land was made for the benefit of distant actors through a narrative championing job creation and modernization of the local community. Experts champion the benefits of job creation while failing to account for other normative considerations like the prioritization of long-term health of water, soil, air, social, and cultural perturbations from the massive scale of extraction and munitions making.

The discursive mobilization of regulatory and production expertise constructs risk at Radford Arsenal's open burning ground. Experts justify risk by emphasizing rhetoric which

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219 Lerner.

220 Auyero and Swistun.

221 Environmental sovereignty is useful term for describing how one can think of the environment outside of the framework of human use and human action. I have deployed the term in terms of the work of securing environmental sovereignty. Dana J. Graef, "Negotiating Environmental Sovereignty in Costa Rica," *Development and Change* 44, no. 2 (2013).

appeals to the social good of weapons production as necessary to defend ‘freedom’ in the United States to ensure the maintenance of national security. These experts use discourse to support open burning hazardous waste as an acceptable risk. Expertise in managing risk is crucial to framing knowledge relationships within a fenceline community. Those permitted to open burn deploy strategic modeling data to discursively represent safety of the fenceline, environment, regulatory and operator relationships. Questioning the safety of open burning by activists is reframed by producers as a threat to the jobs and ‘national security’ the plant provides.

Risk is assessed through mobilization of certain data while omitting other data. The construction of data is a crucial component of how regulatory and production experts challenge risk claims brought by fenceline residents. Constructing uncertainty amongst public activists about their positions, through data which supports tolerable conditions of open burning, is crucial to the function of discourse mobilized by open burning proponents.

Open burning data is not based in the practice of open burning at the local site, but is abstracted from contained bang box modeling with meteorological conditions of an airport over 30 miles away.<sup>222</sup> Omitting fenceline measurement is crucial to the evaluation of risk on the fenceline community by open burning proponents and regulators. The strategic crafting of the politics of knowledge of risk is a crucial node in the contentious network of relationships between risky industrial activities and fenceline communities.

Similar to Black Mesa, production and regulatory expertise at RAAP excludes fenceline knowledge in calculations quantifying fenceline risk and tolerable levels of exposure. Producers and regulatory experts consider the effects of the operation of production on the people of the extraction zone and the munitions making fenceline abstractly. Ethnographic, or first-hand accounts, do not constitute production and regulatory evaluations of risk. Instead, fenceline knowledge is delegitimized by abstract, predictable, modeling of risk without an adequate inspection of the complex interactions between large sociotechnical systems and fenceline communities.

Experiences on Black Mesa helped me to understand the legal logic of how sociotechnical systems cause socioenvironmental harm and reproduce inequality through jurisprudence, expertise, and exclusion of fenceline knowledge. I learned how people can organize, put pressure, and create solidarity across boundaries. Fenceline residents on the Mesa told a story of environmental and social suffering to achieve impact and voice concern over the mining. Termination of ground water extraction to slurry coal in an arid region and the cessation of coal burning at a large naturalized and distant power plant occurred through activist resistance and cooperation enabled through the sharing of stories of suffering.

I brought these understandings to interrogating the construction of risk at the Radford Army Ammunition Plant and my own fenceline experience. How does the discourse of safety emanating from plant officials create a discourse of risk management that is based upon abstract assumptions about the lives of fenceline residents which exclude key insights of fenceline knowledge?

Black Mesa illustrated that the coproduction of risk and safety are discursive concepts through which the notion of tolerance of risk is socially constructed within fenceline communities.

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222 See figures for a wind rose from Roanoke airport that informs the 2005 Human Health risk Assessment for the Open Burning Ground.

I illustrate a similar process in context to open burning by discussing my own participation with experts, secrecy, and technical language needed to understand permit and risk assessment assumptions.

Risk assessments and discharge permits, as texts, form the discursive expertise of plant operators, managers, and regulators. These texts are used to legitimize control and management of risk by pretending to account for fenceline experience. Producer and regulatory expert discourses of risk conceptualize fenceline experience abstractly. Abstraction engenders power relations of social inequality by deprivileging the standpoint of fenceline knowledge and expertise while elevating regulatory and production expertise as superior.

My experience on Black Mesa began with a mapping project for a legal research team. The benefits of mapping a site helps fenceline residents understand their location in relation to what is inside the fence. I show how fenceline residents need to mobilize expertise in order push frontiers of interdisciplinary, scholar-activist research around industrial pollution.<sup>223</sup> A cartography includes the mapping of wells, food sources, gardens, wildlife resources, agricultural resources, topography, air quality, emissions points, and facilities.<sup>224</sup> Mapping requires the sharing of information, tactics, and experience to enable fenceline communities to have a greater chance to build momentum by addressing local environmental justice issues while simultaneously organizing and sharing global solidarity through shared experience with other fenceline groups experiencing injustice. Building a cartography of environmental permitting processes helps to actively intervene in the construction of risk discourse in and around the fenceline. Mapping can be a powerful to codify and disseminate fenceline knowledge and expertise.<sup>225</sup>

To begin a cartography of risk, I examine the central texts managing risk from open burning: the 2005 open burning ground permit, and two supporting risk assessments; the Human Health Risk Assessment and The Screening Level Ecological Risk Assessment. These texts are crucial discursive justifications for open burning. An analysis of their risk discourses provides insight and understanding into how permits are legitimized through the construction and deployment of narratives of safety, control, prediction of operating conditions, and tolerance. An analysis of the construction of risk at RAAP's open burning ground shows how safety is discursively produced through open burning risk analyses conducted in 2005 for the currently expired Virginia Department of Environmental Quality's Open Burning Ground Permit.<sup>226</sup>

The operation of the hazardous waste management open burning ground (HWMU-13) at Radford Arsenal is uncertain due to lack of control associated with the practice. Open burning is fundamentally risky because of the lack control of the combustion process. By its very nature, the process of open burning hazardous waste cannot fully and adequately control temperature, oxygen content, and turbulence of the material to ensure the most efficient combustion. No monitoring is in place to determine the effects of open burning and actual combustion efficiencies. Furthermore,

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223 With the generation of accounts that analyze and present narratives of controversies of environmental pollution it will be far easier to disseminate knowledge of risk so that communities can cross collaborate on similar but different issues that affect them from the production of hazardous waste found in many industrial processing facilities.

224 Such a fenceline bottom-up cartography is being conducted by Forgotten People within the mining area of the Kayenta and Black Mesa Mines. This allows for constant monitoring of potential negative risks wrought by polluters.

225 See the receptor grid map in the figures section which show how Virginia DEQ approved a permit based on fallout map modeling open burning deposition in a linear, square like, dispersion.

226 This permit is expired, but is in a shielding process which means that until a new one is approved the old one is in effect. According to VA DEQ the permit might be renewed in 2017.

when lead is open burned it transformed into lead oxide and dispersed as particulate matter into the surrounding community.<sup>227</sup>

I articulate a model through which STS practitioners engaged in risk research can contribute valuable experience and knowledge to the study of risk and safety within a fenceline. The normative aim of this work is to bolster public understanding and participation in the process of risk evaluation and acceptable limits of exposure in and around the fenceline of large polluting industries. Specifically, my focus on the military-industrial complex offers a model of research at the nexus of environmental impact, risk, and justice of one of the largest polluters in the world: the United States' Department of Defense through the micro-case of the Radford Site.<sup>228</sup> The US Military open burns waste across the world and at many installations in the United States. Increasingly health effects are becoming documented.<sup>229</sup>

I normatively build the case for the formalized research in fenceline sites that commits to building solidarity across fenceline sites by providing a forum for sharing fenceline expertise. I argue scholar-activist researchers in fencelines can compile data on how risk assessments operate at production facilities. This research can provide empirical analysis of risk assessments by taking into account a wide array of scientific, medical, and technical knowledge, in order to question the assumptions of the risk assessment. This account is one model among many potential avenues of scholar-activist research that examines the politics of knowledge and risk in context to open burning hazardous waste domestically by Department of Defense sanctioned organizations.

Empowered communities in the politics of risk builds resilience. Understanding how risk is constructed helps communities broaden their knowledge and expertise by empowering fenceline knowledge of and expertise to seek better objectivity of the scientific and social understanding of hazardous sites. Building on the concept of citizen science this work illustrates how fenceline activism can influence the politics of knowledge of risk on the fenceline. I illustrate a research program calling for fenceline inquiry which encourages citizen-science based independent assessments of environmental issues in their communities.<sup>230</sup> In order to situate open burning from the fenceline-scholar-activist perspective, I examine the history of RAAP's construction and emergence within context to my development along the fenceline.

### ***Brief History of Radford Ordnance Works:***

Construction of The Radford Arsenal began in 1940. The facility was constructed "As one of the Ordnance Department's Government-Owned Contractor-Operated industrial facilities."<sup>231</sup>

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227 Science is documenting the relationship between lead exposure and violence. See: Paul B. Stretesky and Michael J. Lynch, "The Relationship between Lead Exposure and Homicide," *JAMA, The Journal of the American Medical Association* 286, no. 6 (2001). Cindy Ngo, "Lead Exposure Link to Violence," *The Express* 2016.

228 See: Alexander Nazaryan, "The US Department of Defense Is One of the World's Biggest Polluters," *Newsweek*, <http://www.newsweek.com/2014/07/25/us-department-defence-one-worlds-biggest-polluters-259456.html>.

229 Lauren Walker, "US Military Burn Pits Built on Chemical Weapons Facilities Tied to Soldiers' Illness," *The Guardian*, <http://www.theguardian.com/us-news/2016/feb/16/us-military-burn-pits-chemical-weapons-cancer-illness-iraq-afghanistan-veterans>.

230 Janis L. Dickinson and Rick Bonney, *Citizen Science: Public Participation in Environmental Research*, vol. 1 (Ithaca: Comstock Pub. Associates, 2012).

231 Ashley M. Neville et al., *The World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) Industrial Facilities: Radford Ordnance Works Historic Investigation*, vol. 6A, U.S. Army Material Command Historic Context Series (Plano, Texas Geo-Marine, Inc, 1996).



The facility was engineered to manufacture explosives, propellants, and other explosive materials for the Allied war effort in World War Two.

Radford's construction formed part of the first wave of manufacturing arsenals utilizing the institutional GOCO model.<sup>232</sup> The War Department estimated in 1940 that with existing smokeless powder operations at government owned and operated facilities (Picatinny Arsenal and Frankford) only 5% of needed munitions production could be produced for the pending war effort.<sup>233</sup> The GOCO model is an acronym for a government owned-corporately operated facility. This model has many unintended and lasting consequences for public access to knowledge about risks from toxic releases and accountability of facility officials to the fenceline communities living next door. Private entities operate at a federally owned facility and are allowed to make a profit.<sup>234</sup>

Decisions that would impact the New River Valley were formalized on August 16, 1940, when the Chief of Ordnance signed a cost-plus-fixed-fee (CPFF) contract with Hercules Powder Company. Hercules was a spinoff from DuPont Chemical Company resulting from antitrust decisions to break the company up. Hercules would oversee the design, construction, and operation of a plant, the Radford Ordnance Works.<sup>235</sup> The government would foot the bill, and the private contractor would oversee production making a profit from operations in the Government-Owned-Corporately-Operated model.

Radford's initial purpose was to manufacture smokeless powder for the allied effort against the Axis.<sup>236</sup> Hercules was an explosives producer for the mining industry, private gun industry, and the military. Leading up to World War Two Hercules was the largest producer of naval stores and the third largest producer of explosives in the nation.<sup>237</sup> Radford manufactured 44 types of propellant with speedy and efficient production that eventually reached 170 percent of its initial rated capacity to fill this gap.<sup>238</sup>

The decision to build the facility in southwestern Virginia on the New River was strategic due to the remoteness of the location in the interior of the state, far away from the coast and potential attacks by a hostile foreign navy or army. Hercules and the United States Government's decision to locate its new facility in Virginia was economic due to robust water resources needed for mass production of explosives and nitrification processes. The location of the facility along the New River was chosen for its remoteness from large populations, proximity to water, connection to railways that transported West Virginia anthracite coal, and the proximity to knowledge centers at the land-grant university of Virginia Tech. Expertise of chemists working at Virginia

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232 Ibid., 12.

233 Ibid.

234 The GOCO model allows the government to say that the corporation has the information or is at fault for a problem, while the corporation can say the same thing back to the government when it is pressed for accountability by fenceline residents. A long chronology of FOIA requests dating back to 2014 illustrates how this model is invoked by producers and regulators to excuse public access to information. The GOCO model embeds secrecy and murkiness regarding who is at fault when things go wrong.

235 Neville et al., 6A, 11.

236 In internalist literature on Radford, smokeless powder, ordnance, explosives, or propellants are the terms given to the products that are/were manufactured on site. Smokeless powder is a type of gunpowder.

237 Neville et al., 6A, 11.

238 Ibid., 9. The specific types of propellants are not specified in any account accessible to the researcher, though the facility did produce TNT.

Polytechnic Institute was crucial to the organization of expert knowledge and technological successes needed to produce explosives in such a short time at RAAP.<sup>239</sup>

Radford Ordnance Works (ROW) was the second smokeless powder plant authorized as part of the National Defense Program, with the contract coming less than a month after the contract for the Indiana Ordnance Works was signed.<sup>240</sup> ROW was the first of six GOCO plants that Hercules designed and operated.<sup>241</sup> Hercules also operated Badger Ordnance Works (1943, Baraboo, Wisconsin), Missouri Ordnance Works (1942, Louisiana, Missouri), New River Ordnance Plant (1941, Pulaski, Virginia), Sunflower Ordnance Works (1943, DeSoto, Kansas), Virginia Ordnance Works (1942, Glen Wilton, Virginia), and Volunteer Ordnance Works.<sup>242</sup> The Anglo-French Purchasing Board entered into contract with the DuPont Company to build and operate a privately owned explosives plant in Millington Tennessee. It was called the Tennessee Powder Company. It was transferred to the War Department on February 22, 1942 and renamed the Chickasaw Ordnance Works.<sup>243</sup>

The Radford Army Ammunition plant initially encompassed 6,901 acres.<sup>244</sup> Two units were built: The units were called the New River Unit (Dublin VA) and the Radford Unit (RAAP). The New River Unit is defunct and the only remaining component is the abandoned load, assemble, and pack plant in Dublin Virginia, in Pulaski County.<sup>245</sup> The Dublin Facility was shut-down due to decrease in demand after World War 2 for chemical explosives.<sup>246</sup> The Radford Unit, the continually operating production facility (the focus of this dissertation), is situated in the foothills of the eastern slope of the Appalachian Mountains of Southwest Virginia.

The Radford Unit is located on rolling land between sharp ridges. These sharp ridges and location in the bottom of a river's deep, wide canyon obscures a full view of the facility. From the major roads, even when trees have lost their leaves in the fall and winter, it is difficult to see the facility unless on private or restricted federal property. The historic New River, perhaps the oldest river on the North American continent, flows through the plant creating the famous Horseshoe Bend on which the plant is located.<sup>247</sup>

According to "Preliminary Environmental Survey Radford Army Ammunition Plant, Radford, Virginia September 1973" the New River Valley region is described in economic development value-opportunity norms. For example,

The largest of the roads in the county are US Route 11, Interstate Highway 81, and US Route 460. The land along these primary roads is either flat or gently rolling, typically a

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239 During RAAP's construction Virginia Tech was a military engineering/agricultural school in which all students were members of the Corps of Cadets.

240 Neville et al., 6A, 11.

241 Ibid., 17.

242 Ibid.

243 Ibid., 11.

244 The size and current operation of the facility is redacted in the most recent report released by the EPA's National Enforcement Investigations Center that was released to the public on 5/28/15.

245 Neville et al., 6A, 9.

246 Certainly scholars should focus on the ramifications of the construction of the Dublin facility, however, for reasons of contemporary exigency, notably the facilities large environmental footprint, ROW is the sole object of inquiry of this study. It is virtually impossible from current documents and FOIA requests, due to redactions, to gauge the types of current activities and production at the plant.

247 Neville et al., 6A, 9.

prime type for development. The county seat is Christiansburg with a population of 7,857 (1970 census)...The most significant geological resource in this area is probably the groundwater. Iron, copper, coal tin, and other valuable mineral occur only in small deposits in the two counties and are economically impractical to exploit.<sup>248</sup>

The area is high in elevation by standards in Virginia. For example “the city of Radford in Montgomery County has the greatest elevation of any city in Virginia, 1776 feet above sea level.”<sup>249</sup> The New River cuts the county line of Montgomery to the east and Pulaski County to the west. The Radford Arsenal is located on the horseshoe bend of the New River in Montgomery and Pulaski counties. The horseshoe bend is a peninsula of land that extends from the west in Pulaski County east into Montgomery. The OLEUM Plant, Finishing area, Solvent recovery area, TNT Plant, Powder Storage, Nitro-Cotton Area, C-Line Waste Acid Plant, Acid Neutralization Plant, Cotton Area, Nitrating Area, Powder House, A-B Acid Sewer, C-Line Acid Line and TNT Open Ditch all are located in Montgomery County south of the New River. The two hazardous waste incinerators, Waste Propellant and Explosive Open Burning Ground, are situated in the Horseshoe Bend in Pulaski County.<sup>250</sup>

The Radford Unit contained two entities at the site: the Radford Ordnance Works (ROW) and the New River Ordnance Plant (NROP). According to Neville et al in *The World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) Industrial Facilities: Radford Ordnance Works Historic Investigation*: “An installation is a plant if only ‘fabrication or assembly’ took place there; it is a works ‘if basic materials were required for production. Load assembly, and pack facilities...were identified as plants during World War II. Facilities that manufactured power, explosives, chemicals or incendiaries were classified as works.”<sup>251</sup> When I refer to Radford Arsenal today, I am referring to what was called the Radford Ordnance Works and New River Ordnance Plant, not the defunct, though contaminated, New River Unit located in Dublin and its fenceline. The plant was transferred to the jurisdiction of the works in 1943. In 1945, ROW was designated the Radford Arsenal with the Ordnance Plant as a sub-post.<sup>252</sup>

The Mason & Hanger Company of New York performed the design and engineering for the plant’s construction and served as the primary construction contractor.<sup>253</sup> According to Neville et al. there were 23,150 employees at the height of construction in March 1941. Radford Ordnance Works was dedicated on March 14, 1941 and production began on April 5, 1941, three months ahead of schedule.<sup>254</sup> The design of the plant was based on Hercules smokeless powder plants in Kenvil and Parlin, New Jersey. An explosion at Hercules’ Kenvil plant on September 12, 1940 caused a rethinking of design for ROW. Original specifications at ROW called for a two-line powder plant with the ability to expand to six. Knowledge gained from the disaster at Kenvil,

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248 Edward S. Bender et al., "Edgewood Arsenal Technical Report: Preliminary Environmental Survey, Radford Army Ammunition Plant, Radford, Virginia, September 1973," (Biomedical Laboratory Aberdeen Proving Ground, Department of the Army, December 1975), 6.

249 Ibid., 11. The quote is incorrect as Radford City is located inside Pulaski County..

250 Material that cannot be put into the hazardous waste incinerators, due to threat of an explosion, is placed into the open burning ground.

251 Neville et al., 6A, 11.

252 Ibid.

253 Ibid.

254 Ibid.

increased the safe distances between buildings, making it so Radford could only support three production lines.<sup>255</sup>

ROW's construction required speedy mobilization of scientific networks, expertise, and material in complex, interdependent relationships and networks. The achievement of mass-production of exploding propellants was not a new development. Picatinny Arsenal in Morris County New Jersey mastered mass-production in World War One. The knowledge and material networks that were achieved in the mass production of propellant during and after World War One were synthesized in the construction of ROW. Technical knowledge and craft learned from years of experience in New Jersey deployed in the design of the ultra-modern Radford Ordnance facility. ROW represented the state of the art of chemical-propellant manufacturing at the time of construction.<sup>256</sup>

RAAP was one of the most modern munitions facilities of its time and deployed new technological innovation in the manufacturing of ordnance and explosives propellant.<sup>257</sup> The facility's capability to mass produce nitroglycerin, nitrocellulose, TNT, OLEUM, and a host other exploding chemical products is/was second to none. Very little information can be found about Radford's production history outside of the Neville document.<sup>258</sup>

The Dublin facility was closed due to decrease in demand for chemical explosives after World War 2.<sup>259</sup> According to Neville et al. ROW was more diversified in its operations than any other smokeless plants during World War II. The diversity of its products were more important than its quantity. Neville et al state, "The description of ROW, which applies from World War II

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255 Ibid.

256 ROW's construction is an example of powerful technological momentum. For example, Thomas Hughes in "Technological Momentum" states: "A more complex concept than determinism and social construction, technological momentum infers that social development shapes and is shaped by technology." See Thomas Hughes in Smith and Marx. 102. See: Jasanoff. Social development shapes and is shaped by technoscience is another way of stating the centrality of the role of co-production whereby technoscience and society co-produce and act upon each other in ways which are not deterministic nor constructivist. Power relations are co-constructed via the networks of intersection between socio-technical processes. Specifically, Langdon Winner argues, "it is no surprise to learn that technical systems of various kinds are deeply interwoven in the conditions of modern politics. The physical arrangements of industrial production, warfare, communications, and the like have fundamentally changed the exercise of power and the experience of citizenship." See: Winner. RAAP's momentum continues today with its large scale pollution and production of ordnance.

257I cannot confirm the status of this today as the as facilities will not disclose specific production techniques though there are many modernization projects taking place. I am aware of these four current tenants: Multinational Arms Dealer BAE Systems, Alliant Tech's New River Energetics, Grucci Pyrotechnique INC, and Alexander Arms are all private companies doing business at the facility.

258 Requests for specifics on what is produced next to my house have gone unanswered. No other term than the generic term 'propellant' is offered by experts. There is a careful avoidance of the use of the term explosives even though the major processes being produced at RAAP are nitrification and attaching nitrogen bonds to cellulose, a signature of explosives. The Ceasefire Campaign obtained evidence that RAAP has a permit issued by The Virginia Department of Health (VDH) for the processing, handling and storage of depleted uranium. VDH issued an approval for Alliant Techsystems Operations (ATK) at the Radford Army Ammunition Plant for the processing, handling and storage of depleted uranium. ATK first applied for a radioactive material license in June, 2009 and the license was issued on May 20, 2010. The license was renewed on July 24, 2015 and has an expiration date of May 31, 2020.

259Certainly scholars should focus on the ramifications of the construction of the Dublin facility, however, for reasons of contemporary exigency, notably the facilities large environmental footprint, ROW is the sole object of inquiry of this study. It is virtually impossible from current documents and FOIA requests, due to redactions, to gauge the types of current activities and production at the plant.

to the late twentieth century, is justified both from the ‘viewpoint of the many types of propellants produced, and the physical propellant grains themselves [that] range in size from smaller than BB shots up through large grains for tactical rocket motors.’<sup>260</sup>

When World War II ended ROW was put into stand-by-condition and turned over to the government in 1945. In June, 1946 the Arsenal produced ammonium nitrate as part of the War Department’s fertilizer production program.<sup>261</sup> In 1949 it was awarded a contract to produce rocket propellant. Since 1949 Radford has continued to produce, with no gaps in production, found in the Louisiana Army Ammunition’s internalist production history. During the post-War War Two period, Radford fashioned cast propellants for rockets such as Honest John, Little John, Nike Atlas, and Nike Hercules.<sup>262</sup> In 1950 the sub-post designation was eliminated and the Ordnance Plant became part of the Arsenal. In 1961 the name changed once again and the installation was called Radford Ordnance Plant and was called such until it was designated the Radford Army Ammunition Plant (RAAP) in 1963.<sup>263</sup> The Radford Army Ammunition Plant is still the facility’s name. The variety of names and units creates substantial confusion to any one carrying out historical or sociological research on this sociotechnical network. Changing names, contractors, actors, and complexity of operations all contributes to production of the secrecy that the facility uses to obscure public participation in understanding and evaluating risk. In the year Neville wrote, 1996, the facility produced “double-base, triple base, and high energy propellant powder”<sup>264</sup>

Exploring the historical context of RAAP’s construction situates the facility’s momentum as a weapons producer. RAAP’s socioeconomic effects throughout the region continue today. The construction of RAAP ushered in an era of rapid industrialization in the rural Appalachian region home to the Virginia Polytechnic Institute. The city of Radford changed in new and dynamic ways. New industries like Grady Foundry would be constructed to provide the metal pipes, castings and parts needed for the construction and maintenance of explosives manufacturing at Radford.<sup>265</sup>

Neighborhoods like Fairlawn in Pulaski County and Airport Acres in Blacksburg would be developed on the outskirts of Radford and Blacksburg to provide housing for the large numbers of workers moving to the area to work at ROW.<sup>266</sup> The neighborhoods are now important landmarks in region’s diversified economy centered on higher education and technical innovation.

Significant changes occurred in the region as coal production shifted south and west out of the McCoy and Merrimac mines toward the rich seams of West Virginia along the New River Valley via Norfolk and Western’s railway. The Virginian Railway, financed by Henry Huttleston Rogers, increased movement of coal and resources and transportation from the richer seams of West Virginia. Virginia Polytechnic Institute grew into a state university and an influx of skilled workers migrated to the region, brought new cultural experiences, and identities to a dominantly white-Baptist/Methodist population of Scotts-Irish descendants from the initial settler-colonialism of Great-Britain.<sup>267</sup> New communities would develop as industrial diversity in the region grew.

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260 Neville et al., 6A, 11-12.

261 Ibid., 12.

262 Ibid.

263 Ibid., 11.

264 Ibid., 12.

265 LaLone et al.

266 Ibid.

267 Ibid.

Paving the way toward this progress and development was the Radford Arsenal who offered high wages, patriotic zeal, and a sense of geo-political importance to the workers who entered its gates tasked with building the chemical potential energy to destroy the enemies of the United States. Knowledge-production networks were brought to support this key node of US military explosives production. These materials, human capital, knowledge, and expert networks would transform a small rural town with an agricultural and engineering school into a large research-one university featuring some of the most advanced and dynamic techno-scientific research innovations in the country.

However, lost in this story is an account of the history of the site and the people who had occupied the land for generations prior to the colonization of Virginia. Information on those who sold their farms and those who were displaced by the construction of the arsenal is difficult to find. Lost is the natural knowledge of a people who had grown to adapt and survive in this ecosystem. The lack of such a body of knowledge and experience would foster my questioning of RAAP's enframing of the landscape as a fenceline resident journeying back from Black Mesa.<sup>268</sup> Lost in all accounts of RAAP is a history of the indigenous peoples who occupied the site prior to the arrival of the colonialists. Unlike Black Mesa little knowledge exists on how the land was used.<sup>269</sup>

While the Arsenal was at one point in time the largest economic generator of the region, today, the situation has changed. The facility no longer generates a monopoly on economic opportunity and culture that it did during its heyday of construction. According to Lieutenant Colonel and Current Joint Munitions Commander of the Facility, Alicia Mason, in January 2016 about 2,200 workers work at the site.<sup>270</sup> These 2,200 workers are a part of a variety of organizations both private and public that operate at the facility: Alexander Arms, Grucci Pyrotechnique, BAE Systems, and Alliant Tech System's New River Energetics, and the United States' Army's Joint Munitions Command.

Today, the universities in Radford and Blacksburg are the largest employers along with Volvo Trucks. In 2011 the plant employed about 1200 workers with great uncertainty as to the number who would keep their jobs once BAE Systems took over as the contractor in 2012.<sup>271</sup> This is still large, but significantly reduced when compared with historical employment numbers that the facility offered the region during its herculean heyday.

The New River Valley is increasingly building a diversified economy across multiple synergistic sectors including education, health, research and development, tourism, and sports. The facility, relative to other large employers in the area, is a disproportionately enormous contributor to environmental pollution according to the most recent Toxic Release Inventory Data.

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268 See: Heidegger's conception of the process of enframement in *The Technological Society*.

269 The genocide of Native peoples in Virginia was very thorough, reconstructing this history is very difficult. When one enters the Army command suit in the corporate office building on RAAP's property, there is a display case filled with artifacts of the people who used to occupy the land of the munitions plant. Plant experts were keen on pointing out a fenced grass field next to the waste-water treatment facilities that was "saved" to guard the Native American artifacts found there.

270 This was reported in a BAE Systems/US Army's joint community relations meeting on January 14th, 2016.

271 Karen Kiley, "Jobs Uncertain as New Company Takes over Operations at Radford Army Ammunition Plant," (May 13th, 2011).

Since 2003 the facility is still the largest polluter in the Virginia as reported by the US EPA. The facility exceeds the pollution of the state's next four highest polluters combined.<sup>272</sup>

***Living STS: The Laboratorization of Socioenvironment around RAAP:***

The previous institutional history helps to situate the construction of RAAP. I do not pretend to offer a full accounting of the sociotechnical history of innovations and cultural change in around the Radford site. Internalist histories of science and technology were rife in the history of science and technology until the development of constructivist approaches that articulated how society shapes and is shaped by particular technologies or sciences.<sup>273</sup> The Ammunition Plant's institutional history is also characterized by internist history with little outside narrative that makes use of the innovations in historical and sociological methods over the past 30 years. Little is written on the plant by outsiders using constructivist methods due to the difficulties in access to the narrative voices of workers and fenceline residents because of the proliferation of Institutional Review Board control, secrecy, and hostility to outsiders who ask about the "work" that occurs at the facility and its relationship with the socioenvironment. Considerable unknowns and missing community voices form a major component of the historical discourse about RAAP.

Radford's fenceline is a laboratorized site at the center of contestations over the meaning of the facility. Ulrich Beck in *Risk Society* argues that part of the human condition living next to technoscientific industrial facilities is the laboratorization of society through the risks created by technoscience. Beck states:

Acceptable levels certainly fulfill the function of *symbolic* detoxification. They are a sort of symbolic tranquilizer pill against the mounting news reports on toxins. They signal that someone is making an effort and paying attention. *In actual fact* they have the effect of raising the threshold of experiments on people somewhat higher. There is no way around it, *only when the substance is put into circulation* can one find out what its effects are (...) The effect *on* people can ultimately only be studied reliably *with* people. Society is becoming a laboratory.<sup>274</sup>

The effect of the laboratorization of the fenceline in the risk society creates uncertainty for fenceline residents. The uncertainty of toxic exposure risks can only be understood through sciences and technologies of dedicated monitoring and inquiry into the conditions of health, air, soil, water, and food production on the fencelines of risky facilities. The laboratory society exposes populations to risks that are unforeseen, unexpected, and unknown, a crucial component of fenceline experience. The reflexivity thesis developed by Beck argues that only through technoscience can we understand, identify molecules, compounds and element interactions that create risk when synthesized and emitted at production facilities.

Laboratorization of the fenceline necessitates that fenceline community members ought to engage in reflexive science to document and record their experiences to empower themselves. Citizen science serves as valuable evidentiary practice, promising that as future knowledge evolves and more data becomes available, fenceline residents will better understand and document the

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272 United States Environmental Protection Agency, "Toxics Release Inventory Program".

273 See the works of Nye, *Electrifying America: Social Meanings of a New Technology, 1880-1940*; Jan Golinski, *Making Natural Knowledge: Constructivism and the History of Science*, with a New Preface (University Of Chicago Press, 2005).

274 Beck, 69.

fenceline. The laboratorization of society through acceptable levels of toxicity can be documented by recording of events, symptoms, releases, noises, and experience. The empirical analysis of community fenceline experience helps to contribute to the better organizing of fenceline communities by reducing the barriers of information creation and sharing enabled by the democratization of digital technology.

No better symbol of the laboratorization of the fenceline at the Radford site is the location of Virginia Tech's Experimental Agricultural Station, downstream, down gradient, and in some meteorological conditions downwind from the open burning ground. Kentland Farm is the location of the university's experimental agricultural station. The farm is on the fenceline of the manufacturing systems of the Radford propellants facility. While named the experimental agricultural station because of the land-grant tradition of agricultural research and teaching exemplified by Virginia Tech's core founding mission, the farm is an experiment in and of itself of food production and weapons manufacturing fenceline colocation.

Beck's formulation allows us to understand that the historical and contemporary chemical releases, permitted by acceptable level discourse, constitute a sociotechnical experiment of vast proportion. Considerable unknowns exist about the production of food next to a weapons making site, though the discourse of acceptable levels makes the situation appear under control. We know very little about the complex interactions and calculations of acceptable limits of exposure agglomerated overtime. This is a condition of the production of ignorance. We inquiry using air and empirical analysis into the interactions between soil, water, and air at the site. No studies examine the context of the temporal experience of humans living and breathing next to operation. We do not have a body of research that examines the experiment of munitions production and agricultural production collocation. No health monitoring is active through a program of research that actively begins from the standpoint of the fenceline. This are few of the many places of social and scientific research that could reduce the production of ignorance on the fenceline.

Fenceline communities face conditions of experimentation. To counter unknowns, fenceline community members can document the experiments of living on the fenceline. A fenceline standpoint of research mobilizes empirical science by studying the soil, air, and water, analyzing risk evaluations in fenceline communities, conducting community health studies and a whole range of research and inquiry into that begins with the standpoint of the valuable knowledge that fenceline community members can contribute to empowering themselves in pursuit of epistemological, social, and environmental justice.

For example, the work documented by Steve Lerner and organized groups like Citizens for Safe Water around Badger (CSWAB), at Radford's shuttered sister facility, are powerful examples of how fenceline experience can be documented, studied, and shared in a normative framework that empowers the fenceline.<sup>275</sup> Groups like Global Community Monitor work with fenceline communities by empowering residents to record and document fenceline conditions and to understand emissions and risk through empirical monitoring.<sup>276</sup> Fenceline residents gather data and scientific evidence along the fenceline to intervene in the politics of knowledge and risk on the fenceline.

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275 Lerner. The Badger Army Ammunition Plant is Radford's sister plant built according to similar specifications also constructed by Hercules.

276 "Who We Are," Global Community Monitor, <http://www.gcmonitor.org/about-us/>.



As technologies become available to the public, our ability to understand and make meaning of our technoscientific world becomes more robust and democratized through quickly deployable evidence based tracking and data production. Fenceline communities increasingly possess tools to track ongoing experiments of living on the fenceline through data collection and analysis not beholden to the fiduciary motives of regulators or producers, a crucial development emerging from the lead poisoning tragedy in Flint, Michigan.

Information about exposure, pollution experience, and health effects can be stored and shared across boundaries, enabling better networks of fenceline knowledge and expertise. As knowledge constantly changes and evolves about the effects of techno-scientific, social experiments, fenceline residents have the agency to document and record. Their data helps in creating a narrative and developing an account of fenceline experience and expertise. Fenceline residents can develop their own expert accounts of what it means to live at the fenceline, independent of production and regulatory expertise.

What is recorded today could become evidence in the court of law tomorrow or valuable information for risk calculations. Evidentiary and empirical practices by fenceline communities fosters planning and flexibility as adaptive approaches to the risks confronted on the fenceline. Empiricism helps to marshal evidence as new information and data are documented, stored, and shared to find polluters accountable for their actions. Fenceline knowledge and expertise can play a valuable role in speeding up the delivery of information to understand evolving conditions on the fenceline to better construct sociotechnical fixes to remedy socioenvironmental problems,.

#### ***Situating the Scholar-Activist within the History of RAAP:***

As a scholar-activist, I engaged in the practice of evidentiary empiricism to the best of my ability, given funding and time constraints. Due to the circumstances of secrecy and ignorance at RAAP, a unique approach is required because very little research exists, in any field, which pays attention to active ordnance producing complexes and their toxic legacy and contemporary risk for fenceline community members.

Instead of examining the many challenges at the Radford site, I focused specifically on open burning because of the primitive nature of the waste disposal practice and the contemporary debate over its safety. Elucidated by developments coming out of the Camp Minden Dialogue, Radford's open burning ground serves as a micro-level site to practice scholar-activist critical technology studies in context to macro-level analysis of institutions like the military-industrial-complex. Challenging the safety of open burning contributes insight into social issues of science and technology that heavily concerned the early founders of the Frankford School.

A result of the neoliberalization of the weapons industry, the major contractor operating the open burning ground at a United States military facility is a foreign multi-national defense contractor/weapons dealer: BAE Systems; whose headquarters is in London.<sup>277</sup> The facility employs fewer people from its height in World War II, yet was the second largest polluter by mass

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277 See: Neville et al., 6A, 11. At the height of its construction 23,150 employees worked at the plant in March of 1941

of toxic emissions in 2010 in the United States and the is largest in the Commonwealth of Virginia since 2003.<sup>278</sup>

The neoliberalization of the propellant production industry was enabled by policies advocated by the region's former US Congressman Rick Boucher. In 1992 Boucher developed the Armament Retooling and Manufacturing Support (ARMS) Initiative.<sup>279</sup> The stated purpose of the initiative was "to ensure a continued industrial base for the manufacture of ammunition by encouraging the peacetime use of government-owned-ammunition-manufacturing facilities for military and nonmilitary commercial manufacturing."<sup>280</sup> The ARMS initiative radicalized the GOCO model by facilitating greater commercial use of the Federal Facility.

The facility faced the threat of possible closure after the cold-war demobilization. To sustain momentum, the government would actively solicit and import commercial tenants to operate at Radford, championing job creation and economic opportunity to fenceline. These tenants would benefit from unique environmental permits only issued to the Federal Facility because of the national security necessity of the military worked carried out there. Corporate tenants are allowed to place their waste into the open burning ground. Private companies benefit from cheap waste disposal practices afforded by the facility by government protection. They are allowed to operate as for-profit businesses, at a facility owned by the government, while disposing their waste at taxpayer's costs.<sup>281</sup>

Within the context of neoliberalization of Radford Arsenal, I grew up on the fenceline in the late 1980s and 1990s. My youth was spent surrounded by the Appalachian Mountains, outside the town Blacksburg. In late December of 1996, I moved to a house 7.25 miles west of Blacksburg half a mile north-northeast of the horseshoe bend in the New River on Millstone Ridge. I was 9 years old. I recall vivid conversations between family members if we were "too" close to the arsenal. A family member would ask if we were going to be "Close enough to see the lights?" The arsenal was cited as the largest consumer of electricity by one Army installation.<sup>282</sup> It would not be the lights that garnered my curiosity, but the explosions, hums, bangs, pops, smoke, sirens, smells, plumes, and fireworks testing witnessed over the many years.

Recalling conversations about visible lights from the arsenal, I was ignorant of its existence and its *raison d'être* for many years. I knew the facility as a mysterious place; shrouded in secrecy. I played in an indoor soccer league in the winter of 1997 on the grounds of the plant in a dilapidated recreation facility with other young boys from around the Blacksburg/Christiansburg area. We used the arsenal's gymnasium to practice and play games. I was afraid to pass through the gates. Each week when arrived, I asked if we were going to get through the gate? I questioned what

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278Please see: Rex Springston, "Toxic Chemical Pollution Drops in Virginia," [http://www.richmond.com/news/virginia/article\\_52140574-b503-11e3-b3b1-0017a43b2370.html](http://www.richmond.com/news/virginia/article_52140574-b503-11e3-b3b1-0017a43b2370.html).and Kiera Butler, "America's Top 10 Most-Polluted Waterways," Mother Jones, <http://www.motherjones.com/blue-marble/2012/03/top-10-polluted-rivers-waterways>.

279 John J. Accordino, *Captives of the Cold War Economy: The Struggle for Defense Conversion in American Communities*, vol. 1 (Westport, Conn: Praeger, 2000).

280 *Ibid.*, 108.

281 It is unlikely that a private company would be granted a permit to open burn hazardous waste if the word was not national security oriented. Clean Harbors' Colfax, Louisiana facility is an exception to the norm.

282 According to Katherine Hammack, assistant secretary of the Army for installations, energy and environment, the Radford Arsenal was the 'largest energy consumer in the Army.' Reported by Jeff Sturgeon, "Cuts Would Hobble Radford Army Ammunition Plant, Official Says," *Roanoke Times* February 21, 2013.

would happen if the guards did not believe my mother's statements that we were there to play soccer?<sup>283</sup> I didn't understand why we had to pass checkpoints with a stern man in a uniform giving the car a firm casing when we were just playing indoor soccer. "Hush," my mother said. "We will get through."<sup>284</sup>

The gymnasium was eerie. It had old white paint, faded yellow, with the yellow light of high pressure sodium lights humming away. The place seemed mysterious, a center of activity, where things happened, with papers and cabinets in the left hand corner past the entrance. I recall wanting to ask anyone I saw what this place was? I never asked as it was dark when I arrived and dark when I left. I only saw the gate keeper and my fellow teammates. A veil of mysterious secrecy remains the enshrining characteristic of the factory when I think of it. I was deeply mystified by these chemical facilities. We often found our youth soccer events hosted by chemical facilities in the Appalachian region. We played in a soccer tournament on the brown fields of Eastman Chemical facility in Kingsport, Tennessee.

My birth 6.5 miles from the facility in Montgomery County, Virginia and the subsequent intellectual and personal development was spent surrounded by the families of Virginia Tech professors situated among significant intellectual and material resources. My time living at my parent's residence less than ½ mile north-northeast of the Radford Arsenal would lay the groundwork for my interest in the relationship between technology and the environment. These experiences provided the intellectual curiosity for this dissertation.

Taking many car trips to Detroit, I understood Appalachia was used for mineral resource extraction collocated with risky petrochemical plants along the New River/Kanawha River. The area from Huntington, West Virginia to Charleston is known as Chemical Valley. I came to understand that the Radford site, upstream, could be understood as the beginning of the fenceline of Chemical Valley.

My concern with environmental degradation gave impetus to my fascination with the Radford Arsenal as an artifact of knowledge, science, technology, production, labor, waste, and destruction. My upbringing surrounded by the knowledge center, expertise, material wealth, and intellectual resources at Virginia Polytechnic Institute influenced the ideas, conversations, discussions, conferences, and intellectual mentorship that fostered my interest in Science and Technology Studies and environmental justice around a local fenceline, fundamental to my upbringing.

Blacksburg, Virginia is well within the region of Appalachia, according to the Appalachian Regional Commission. Montgomery and Pulaski County are within the geographic space designated as Appalachia. Blacksburg is only 1.5 hours, by car, from the nearest Mountain Top Removal extraction sites in West Virginia and Virginia.

The immense scale of poverty, environmental destruction, and urban decay that is within and beyond the borders of the New River Valley region are powerful symbols that prompted me

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283 For foundational theory on the connection between memory, remembering, and the construction of historical narrative in autobiography please see the works of Paul Ricoeur and Roland Barthes. See also: Paul Ricoeur, *Temps Et Récit: Tome 1: L'intrigue Et Le Réceit Historique*, vol. 1 (Paris: Éditions du Seuil), Barthes.

284 Apparently during the 1990s it was standard practice for Appalachian children to play soccer at chemical factories. I played with the New River travelling soccer Team and we played in a tournament at the Eastman Chemical Company's facilities in Kingsport, Tennessee.

to interrogate the logic national sacrifice within the region. The factories that dot the I-77 corridor through West Virginia, along the New River, and the Kanawha River are fantastic surreal places lit at night in the subliminal manner to convey power, authority, and control.

I was profoundly intrigued due to their constant spewing and seemingly gigantic orientation into the landscape as a child growing up in rural Appalachia. Within this milieu I was aware of the conflict between environmental ruin and economic development so familiar with those who reside in Appalachia. However, I did not consider such a dynamic to be present in my hometown of Blacksburg. The all too frequent clash of technological and economic imperatives with environmental sovereignty was a familiar theme of my upbringing on the frontiers of the Appalachian Sacrifice Zone, but I did not identify as a fenceline resident.<sup>285</sup>

The experiences of seeing and working with activist communities for environmental justice in Black Mesa would force me to consider the counterfactual question of how would the politics of risk operate at Radford Arsenal work if the indigenous Cherokee that called this land home had not been subjugated and killed through settler colonialism? How could I understand my own fenceline knowledge in relation to stories untold of places naturalized into the settler colonial project?

I intended to take this line of thinking to interrogate fenceline risk in similar ways that I had observed the residents on Black Mesa. Many years would pass for me to put the pieces together regarding the Radford Arsenal; including coming to terms with my identity as a fenceline resident. Seeing other fenceline experiences and the unique risks confronting those living in these spaces I came to understand my identity as a fenceline resident.<sup>286</sup> Acknowledging deficits of indigenous knowledge in the New River Valley I sought to activate a critical praxis and awareness of what I had observed on the reservation to the fenceline of the Radford Arsenal.

There are considerable barriers to fenceline organizing in the New River region. Divisions in the community work to divide people over the meaning of the arsenal and its legacy. There is also significant dislocation from the land. Around Radford, people do not rely on agriculture as much as in the past. This is a fundamental weakness for community members concerned with the effects of risk from sociotechnical activities in the region. We have no long standing connection to the land as found in Black Mesa. There is no indigenous history of the sacredness of the river on which to rely. There is no passing down, through generations of indigenous knowledge, of stories about the sacredness of the Radford site. Instead indigenous presence at the site has been confined to the display case in the Army suit of at the facility's corporate offices, or behind fences next to the waste water processing facilities.

The technological sublime informs a major component of the historical narrative of settler colonial progress found in the dominant texts recounting the development of the Radford site. Narratives emphasizing the sublime were frequently encountered as a teenager. I attended Boy Scout meetings with the children of parents who worked at the Arsenal at the Belmont Community Center just downwind from the facility.

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285 JW Randolph, "Appalachia: National Sacrifice Zone," *Appalachian Voices* June 27 2006; Lerner; Randolph; Lerner.

286 For insights into the rough sketching of an ingenious knowledge research paradigm see Smith.

I heard the arsenal every day. I registered the steady hums of the shift change horn at 8am, 12pm, 4pm, and Midnight yearning to live back in the town limits of Blacksburg. The hum of the whistle became part of the audible landscape in the countryside, outside of Blacksburg, while playing backyard football with friends and my brother; or the routine of mowing the 2 acres of lawn that provided me with 20 dollars for the week.

I grew my connection to the land planting and eating from a garden when I was 14 years old just a little under a mile away from RAAP's open burning ground. It never occurred to me to question the environmental impacts from Radford. I did not question if my food was safe. I assumed there was no worry as were a long distance from the ills of the urban city; a place constructed as polluted from the rural perspective.

In a place like Blacksburg, centered on a land-grant university, rich in water resources, in a mountain temperate climate, blessed with biodiversity, it seemed the environment was well protected? The mythology of the New River Valley as a clean and pure region was repeated so many times growing up I internalized it as a child. I thought that Blacksburg was "safer" from toxicity than the urbanized Northern Virginia where my grandparents lived and my parents had left.

I thought the region would be protected by the agents of the development of science and technology in the New River Valley region centered at Virginia Tech. Agricultural researchers, engineers, and biological scientists were leading the world cloning sheep, developing new medical science, bioinformatics, and furthering our understanding of the natural world. Certainly they would ensure that the air and water were safe? Their expertise would safe-guard the community? Just the mere presence of so many highly educated people would ensure that activities were being conducted correctly with human and environmental health in mind? These were the thoughts of a young teenager raised in age of endless promise of the nascent digital post-cold war era of globalization.

The re-membering of the Radford facility is a continual process. I came to understand my identity as a fenceline resident. Understanding the experimental nature of Radford's processes, interactions with the environment, and knowledge of fenceline residents living amidst laboratory conditions is an on-going project. Part of the re-membering of my fenceline experience entails identity changes as I have come to understand toxicity and risk in Blacksburg Virginia downwind of the state's largest hazardous waste open burning ground.<sup>287</sup>

At Radford, very little research is conducted about fenceline environmental effects. Why did not many people talk about the facility unless there was the threat of layoffs, or the annual hunting day in which employees could hunt deer on arsenal property? Constructed ignorance and secrecy work to keep outsiders from conducting programmatic research on the facility. How can you protect or react to something when you are not aware of its existence? My *prise en conscious* of RAAP evolved through my education, surrounding, and up-bringing in the New River Valley region through the witnessing of the inequalities created by the mechanics of expertise, ignorance, secrecy, and risk during my time with the Diné on Black Mesa.

As a legal researcher, I lived an STS case of expertise and risk during my time on the reservation. The experience of taking public comments made visible the vast inequalities

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287 For a theory of memory and historical discourse that utilizes the first person and testifies see: Ricoeur, 1.

encountered in the Bennet Freeze and the extraction site. I came to understand similar, though divergent dynamics, of risk within my hometown community from the practices of the state's largest polluter, which often went unnoticed and in many cases unknown.

The complexity and secrecy of the facility could take years to study from a variety of different perspectives as new information is produced and made available. My fence-line identity challenged this research of open burning. I came to understand my residency in an experimental zone, at the edge of an open burning ground.

***The Production of Ignorance at RAAP: We Cannot Answer Questions We Refuse to Ask:***

Today it remains a mystery as to exactly what is produced due to Department of Defense secrecy and classified knowledge.<sup>288</sup> At a public meeting January 14, 2016, officials refused to say anything other than "propellants" are produced next to the houses of many community members. Not having specific molecular and elemental structures or chemical processes available to the public obfuscates fence-line residents' ability to understand the chemistry of processes and evaluate the risk from production and waste disposal occurring next to their homes and schools.

Part of the issue of the lack of disclosure of information around RAAP stems from four major processes: First, an outright national security secrecy regime works at the Radford site. It is a strategic military defense facility and the only domestic supplier of the key component of nitrocellulose according to available information.<sup>289</sup> For example, in a 2009 article by the Joint Munitions Command, Ms. Barati, Kent Holiday, vice president and general manager of Aliant Tech Systems, the contractor that operated Radford from 1995 until 2012 was quoted, "think about the ammo in Afghanistan and Iraq, 99 percent of the small caliber ammo contains NC [nitrocellulose] from this facility."<sup>290</sup> In the same article former commander Lt. Col. Jon Drushal explains how Radford is the sole North American source for Nitrocellulose. He states, "Radford is the sole North American source for Nitrocellulose. NC is the key ingredient in the manufacture of all propellants."<sup>291</sup> An article by *United Press International* emphasizes how important RAAP is to the war effort:

Radford is the heart of the U.S. ammunition industrial base. All the U.S. armed services are dependent on the products that come from the plant -- not just the U.S. Army, which owns the facility. The Radford plant is a unique facility. It alone among the 14 existing plants of the U.S. ammunition-producing industrial base has an acid-concentrator facility that produces the nitric and sulphuric [sic] acids that, when combined with cellulose in a one-of-a-kind facility at Radford, make nitrocellulose, the essential ingredient for all propellants and explosives used throughout the U.S. Army's ammunition industrial base.<sup>292</sup>

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288 The only thing producers will say is produced are propellants. Justine Barati Director of Public and Congressional Affairs for the Joint Munitions Command stated in January 14th, 2016 meeting that they produced "propellants." When asked to clarify what that meant, officials would have said that such information cannot be released in a post-9/11 world, as it is a matter of national security.

289 Daniel Goure, "You Can't Fight a War without Nitrocellulose," *United Press International*, [http://www.upi.com/Top\\_News/Analysis/Outside-View/2009/05/12/You-cant-fight-a-war-without-nitrocellulose/78041242147842/](http://www.upi.com/Top_News/Analysis/Outside-View/2009/05/12/You-cant-fight-a-war-without-nitrocellulose/78041242147842/).

290 Justine A. Barati, "Radford Looks to New Plant," *U.S. Army*, <http://www.army.mil/article/15990/>.

291 *Ibid.*

292 Goure.

While none of this information can be confirmed through official information requests this points to the national security secrecy that surrounds the facility and its uniqueness as a key component in the industrial base of the United States military machine. After BAE Systems took over in 2012 considerable less information is available. Very little information exists post-2012 on the production at the site. The strategic nature of this facility make it difficult to obtain information, which is well documented in other STS studies about nuclear sites.<sup>293</sup>

The second reason for lack of information is the Radford Army Ammunition Plant's GOCO business model. Historically, the facility is a GOCO facility, which means that the government owns it while a corporation operates it. In 2016 many corporations operate at the site which is a historical aberration compared to Hercules' historic monopoly at the site. In the GOCO model, the government can say that information is privy to the contractor and the contractor can say information is privy to the government.<sup>294</sup>

The third process that contributes to difficulty in access information at the site is the neoliberalization of weapons production. More than just one private entity operates at RAAP. Private companies can claim corporate business secrecy as a reason not to disclose information. Neoliberalization of the weapons industry radicalizes the GOCO model. After three years of research I have yet to find a complete list of all the corporate actors at the site.

A fourth reason for secrecy and lack of information is that the facility was deliberately removed from the National Priorities List in 1999 or 2000.<sup>295</sup> The deliberate construction of ignorance works to sustain narratives of safety through the omission of critical data needed to understand the facility's effects offsite. The National Priorities List is "the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation."<sup>296</sup> The site was listed on the National Priorities List on March 4, 1999, but was removed and issued a 'unique' Resource Conservation and Recovery Act permit in 2000 by the US EPA.<sup>297</sup> RCRA is defined as the "...the public law that creates the framework for the proper management of hazardous and non-hazardous solid waste. The law describes the waste management program mandated by Congress that gave EPA authority to develop the RCRA program. The term RCRA is often used interchangeably to refer to the law, regulations and EPA policy and guidance."<sup>298</sup> The delisting of the facility from

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293 See: Michele Stenehjem Gerber, *On the Home Front : The Cold War Legacy of the Hanford Nuclear Site* (Lincoln, Neb.: University of Nebraska Press, 1997). Gusterson.

294 I documented this when I asked for records of the computer inventory system that tracks all constituents entering the Open Burning Ground that was mentioned in a May 8, 2014 and December 10, 2014 community relations meeting by BAE Systems and US Army personnel. To date, no information has been provided to me about the composition, times, and dates of open burning activities or fireworks testing. BAE's representatives use the excuse that the Army has the information, while the Army says that BAE has it, which then claims that it is a corporate secret.

295 There is uncertainty with regards to when it was removed, but according to documents in the figures section it was listed in 1999, and a "unique" RCRA permit was issued in 2000. See: table of figures for the, now missing, EPA document that specifies that the facility was issued a "Unique RCRA" permit.

296 United States Environmental Protection Agency, "Superfund: National Priorities List (NPL)," <http://www.epa.gov/superfund/superfund-national-priorities-list-npl>.

297 United States Environmental Protection Agency Office of Resource Conservation and Recovery, "Region 3 Develops a Unique Corrective Action Permit for the Radford Army Ammunition Plant in Virginia," <http://www3.epa.gov/epawaste/hazard/correctiveaction/success/r3radford.htm>. See appendix for website image of the listing of the site in 1999. See also Lubieniecki and Mattern.

298 United States Environmental Protection Agency Office of Resource Conservation and Recovery.

SUPERFUND means that no offsite testing was conducted. SUPERFUND provides for more robust community involvement, participation, and can find polluters guilty making them pay the costs for cleanup. This is a significant difference under RCRA. Offsite testing of wells would most likely have been conducted if SUPERFUND was applied, as well as a community health study. The environmental impact has not been discussed in research because of the regulatory categorization of the facility.

The differences of establishing a RCRA or Superfund site are similar though different. According to the institute for Tribal Environmental Professionals at Northern Arizona University, the main difference between the Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] of 1980 is that RCRA is an approach to manage solid and hazardous waste at facilities that are currently active. CERCLA is focused on the management and remediation of abandoned, non-operating sites with media contaminated with hazardous substances. Unlike CERCLA, RCRA facilities' owners and operators are known to be currently using, managing, or disposing of hazardous wastes. RCRA also regulates the transport of hazardous waste.<sup>299</sup> Due to the fact that Radford was not designated a Superfund site under CERCLA there was no community group technical advisor under the technical assistance grant program. CERCLA provides for the establishment of a technical assistance grant and advisor while RCRA does not. An assignment to RCRA ensured that no private wells or health studies would be conducted outside the fence of the Radford Arsenal. Much of this space falls outside of town representation by Christiansburg, Blacksburg, or the City of Radford.

A further limitation of using only the RCRA process at Radford is that CERCLA does not provide for relocation so long as "...when EPA has made a finding that relocation of residents is required to successfully conduct the remedial action."<sup>300</sup> CERCLA can also impose fines on the polluter and make them pay for the cleanup. Through the construction of ignorance we do not know the full extent of the laboratorization of the area surrounding RAAP. The lack of knowledge and data is attributed to the deliberate fact that questions have not been asked to determine the migration of toxicity offsite. This is the condition of willful construction of ignorance on the fence line.

A 1987 EPA National Investigations Enforcement Center report shows that the facility was prioritized in need of immediate remediation.<sup>301</sup> The delisting of the facility from the NPL is fundamental to the story of denial about the facility's toxic emissions in the New River Valley. Since 9/11 the facility has experienced a huge increase in emissions. Taking the facility off the NPL right before 9/11 greatly reduced public participation and constructed the facility in a much less risky way than if it had remained on the NPL.<sup>302</sup> Since 9/11 the facility's emissions have skyrocketed.

The consequences of the exclusion from SUPERFUND meant less testing and monitoring offsite and reduced community participation. Very little outside expert review of the facility's

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299 Institute for Tribal Environmental Professionals, "ITEP - Waste Management - Hazardous Substances - RCRA vs. CERCLA," [http://www7.nau.edu/itep/main/HazSubMap/twrap\\_HzSubMap\\_rcra-cercla.asp](http://www7.nau.edu/itep/main/HazSubMap/twrap_HzSubMap_rcra-cercla.asp).

300 Ibid., 2016.

301 Lubieniecki and Mattern, 12.

302 Further investigations are needed with regards to the NPL status of Radford Army Ammunition Plant. Some fence line accounts have mentioned that Governor George Allan removed the facility from the Superfund list.



negative impacts, including air emissions of highly toxic material from open burning, has been conducted in a methodological and rigorous way that examines whether toxins are moving offsite through robust fence-line monitoring of air, soil, and surface and groundwater.<sup>303</sup> No independent scientific studies have been conducted on the legacy toxic contamination from munitions making as well as ongoing releases.

As of January 28, 2016 no arsenals or ammunition plants were on US EPA's National List of Priorities Deleted Sites.<sup>304</sup> There exist a number of arsenals and ammunition plants that are part of the USA EPA's National Priorities List (NPL) Superfund: Redstone Arsenal (USARMY/NASA), Rocky Mountain Arsenal (USARMY), Picatinny Arsenal (USARMY), Alabama Army Ammunition Plant, Riverbank Army Ammunition Plant, Joliet Army Ammunition Plant (Load-Assembly-Packing Area), Joliet Army Ammunition Plant (Manufacturing Area), Iowa Army Ammunition Plant, Louisiana Army Ammunition Plant, Lake City Army Ammunition Plant (Northwest Lagoon), Cornhusker Army Ammunition Plant, Milan Army Ammunition Plant.<sup>305</sup> As of January 28<sup>th</sup>, 2016 the Dublin Facility was not listed on the formerly used defense sites inventory for Virginia.<sup>306</sup> The sister arsenal of Radford, The Badger Army Ammunition Plant is listed on Formerly Used Defense Sites, and also has a RCRA corrective action permit, but is not part of the superfund list despite significant contamination.<sup>307</sup>

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303 Peter Dufour, president of Environmental Stewardship Concepts in Richmond Virginia, did consult some permit modification proposals at the request of the New River Environmental Patriots. This firm was contracted in 2016 to conduct an independent technical review of the proposed open burning ground renewal.

304 United States Environmental Protection Agency, "Deleted National Priorities List (NPL) Sites - by State," <https://www.epa.gov/superfund/deleted-national-priorities-list-npl-sites-state>.

305 "Superfund: National Priorities List (NPL)," <https://www.epa.gov/superfund/superfund-national-priorities-list-npl>.

306 US Army Corps of Engineers, "Formerly Used Defense Sites (FUDS) Per State: Virginia," ed. US Army Corps of Engineers (Army Corps of Engineers, 2013). See: "The Formerly Used Defense Sites (FUDS) Inventory " (September 30, 2013).

307 For a visual representation of these facilities see the map I created: Gregory Nelson, "Mapping Arsenal Fence-line Locations," (Google Maps, January 28, 2016).

Here are a list of active Joint Munition Command Federal Facilities: According to the US Army's Joint Munitions Command there are the Anniston Munitions Center, Blue Grass Army Department, Crane Army Ammunition Activity, Hawthorne Army Depot, Holston Army Ammunition Plant, Iowa Army Ammunition Plant, Lake City Army Ammunition Plant, Letterkenny Munitions Center, McAlester Army Ammunition Plant, Milan Army Ammunition Plant, Pine Bluff Arsenal, Radford Army Ammunition Plant, Scranton Army Ammunition Plant, Tooele Army Depot see: "Joint Munitions Command," <http://www.jmc.army.mil/Default.aspx>. According to US EPA "The National Priorities List (NPL) is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation." Generally Superfund sites are no longer active, while RCRA are more likely to be active: For example, "Congress amended the Resource Conservation and Recovery Act (RCRA) in November 1984, expanding the Act's cleanup provisions and prompting EPA and its state partners to develop the RCRA Corrective Action Program. The program now oversees the investigation and cleanup of nearly 4,000 hazardous waste sites across the country, including many with risks comparable to Superfund sites....RCRA Corrective Action facilities include many current and former chemical manufacturing plants, oil refineries, lead smelters, wood preservers, steel mills, commercial landfills, and a variety of other types of entities. Due to poor practices prior to environmental regulations, Corrective Action facilities have left large stretches of river sediments laden with PCBs; deposited lead in residential yards and parks beyond site boundaries; polluted drinking water wells in rural areas with chlorinated solvents; tainted municipal water supplies used by millions; and introduced mercury into waterways, necessitating fish advisories. At these sites, the Corrective Action Program ensures that cleanups occur. EPA and state regulators work with facilities and communities to design remedies based on the contamination, geology, and anticipated use unique to each site. See: Agency, "Superfund: National Priorities List

In general Federal Facilities, are defined as “Building, installations, structures, land, public works, equipment, aircraft, vessels, or other vehicles, and property, owned, constructed or manufactured for leasing to the Federal government. Common types of Federal Facilities are: Government-owned/government operated (GOGO), Government Owned/Contractor Operated (GOCO).”<sup>308</sup> Radford Army Ammunition Plant is listed as USA Radford Army Ammunition Plant in the EPA database. It is considered a Federal Facility, but is not listed on the National Priorities List or Superfund. Rather it is a Federal Facility that is categorized as “other cleanup activity:” Federal Facility-lead cleanup.<sup>309</sup> According to an EPA webpage accessed on January 26, 2012, entitled, “Cleanups in My Community.” “This site was transferred to the Superfund program for cleanup on 04-MAR-99.” This document suggests that Radford Arsenal was made a Superfund site.<sup>310</sup> However, this is no longer the official record. The decision to not list the facility as a Superfund site stymies community and fence-line residents’ participation.<sup>311</sup> The benefits of having a Superfund site were avoided. Delisting from SUPERFUND is an example where regulators deliberately fail to ask important questions and conduct necessary offsite studies. Today even the discussion the development of a “unique” RCRA permit can longer be found on the EPA’s website.<sup>312</sup>

The exclusion from SUPERFUND means that data does not exist not because questions have not been asked. Rather, questions have been deliberately ignored. Intentionally ignoring questions is part of the process of constructed ignorance on the fence-line of the site. In community meetings held by the BAE Systems and the US Army the public has been told that open burning of hazardous waste has been conducted at Radford for its entire 75 year history and that it is safe despite no scientific empirical offsite studies examining air.

There is a lack of accessible and verifiable public information. Together these deficits work to keep information about environmental impacts under wraps. The complexity of operations at the facility means that when fence-line residents inquire about the “facts” the story from Army and contractor officials constantly changes depending on the day and who one talks to. The uncertainty in official responses embeds the laboratorized conditions inherent in the area throughout 75 years of operations and toxic releases.

In the words of VA DEQ’s Hazardous Waste Permit writer, Ashby Scott, “Considering how old that place is you’d expect it to be blanketed with poison and it’s not.... There’s actually none that’s escaping the site itself ... What we’re seeing is the levels are going down, the controls are actually working. It’s protecting human health and safety.”<sup>313</sup> These comments do not address

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(NPL)”. See: “RCRA Corrective Action Cleanup Enforcement,” <https://www.epa.gov/enforcement/rcra-corrective-action-cleanup-enforcement>.

308 “Enforcement and Compliance at Federal Facilities,” <https://www.epa.gov/enforcement/enforcement-and-compliance-federal-facilities>.

309 “Search Superfund Site Information: USA Radford Ammunition Plant,” <https://cumulis.epa.gov/supercpad/Cursites/csitinfo.cfm?id=0302843&msspp=>.

310 See table of figures for a copy of the document that shows the facility was SUPERFUND.

311 There is a Restoration Advisory Board, but a survey meeting minutes and attendance illustrates that not all board members show up. There has never been a meeting dating back to 2007 with all 6 board members present. Inquiry on who the missing 6th member is have gone unanswered. Questions about how to become a member of the board have gone unanswered. Brian Purdue, “Only Two of Six Board Members Attend Arsenal Meeting,” Radford News Journal, 3-26-16 2016.

312 See figures section for the document that says the facility has a unique RCRA permit.

313 Travis Williams, “Radford Arsenal Cleanup Going Well, Regulator Says,” The Roanoke Times, 1-28-16 2016.

where contaminants are moving or how they are diluting! The 3000 page RCRA Facility Investigation report for SWMU 13 shows that testing conducted by Draper Aden and Associates found considerable contamination of the groundwater.<sup>314</sup> SWMU 13 is the narrow strip of soil between the open burning ground and the New River. Reports from ATSDR and RCRA site investigations show considerable toxicity.<sup>315</sup> Annual ground water reports

Scott's comments are in reference to RCRA permit actions not the open burning ground permit. However, they illustrate how regulators compartmentalize the facility without regard to the whole situation. In fact the proposals in the adopted 2016 RCRA permit reduce monitoring of the soil of SWMU 13 between the open burning ground and the river even though open burning operations continue with daily deposition. VA DEQ's Open Burning Ground Human Health Risk Assessment indicates that the soil and water in the property and adjacent to the property are within a site-receptor grid for deposition from fallout from open burning operations. EPA's Toxic Release Inventory states 3, 868, 672.01 pounds of toxic releases to the air have occurred since 2004.<sup>316</sup> I have smelled releases from my home and have reported them to VA DEQ.

In 2005, Virginia DEQ issued an open burning ground permit to open burn waste which required no ambient air quality monitoring, or soil testing offsite. Instead open burning is conducted in Pulaski County right across the river upwind from schools in Montgomery County without any direct measuring research to adjudicate the claims of regulators about the safety of the practice.<sup>317</sup> In 2010 RAAP was given permission by DEQ to add rotary vacuum filters drums to the open burn as part of their request to open burn demolitions material from the B-line project demolition. Requests for further information about whether PCB's have been open burned at Radford have gone unanswered. BAE Systems open burned PCBs in demolition at the Holston Army Ammunition Plant.<sup>318</sup>

Knowledge deficits produced through secrecy and lack of information constructed by strategic ignorance reduces the public's ability to analyze its risk position from a position not beholden to the maximizing profits ethos of neoliberal military industrial production or regulator stake in keeping production going. Regulators cannot shut down an industry. They will have no industry left to regulate. The direct omission of specific questions and rigorous testing needed to assess the safety of ongoing emissions indicates that fenceline residents' lives have been treated as collateral damage in the Appalachian sacrifice zone around the fenceline of Radford Arsenal.

Knowledge insufficiencies result from the confluence of a variety of factors. Offsite toxin migration unknowns due to deliberate lack of data, unorganized citizens, geographical, topographical, national security secrecy, esoteric expertise, and marginalization of public questions contribute to the lack of clarity on risk from open burning. Frustrated and angry public members, who do not have a voice, and structural bureaucratic inefficiencies prevent responsible parties attending public meetings to have a dialogue that works to minimize risks. Questions about

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314 URS, "Radford Army Ammunition Plant Radford Virginia: Study Area at Solid Waste Management Unit 13 RCRA Facility Investigation Report," ed. U.S. Army (July, 2010).

315 Ibid. Agency for Toxic Substances and Disease Registry.

316 United States Environmental Protection Agency, "Toxic Release Inventory Program".

317 In 2005 and Open Burning Ground Permit was issued by Virginia DEQ that stipulated theoretical permitted amount of Lead Burned each year at 2540.4 pounds of lead or 25,404 pounds in 10 years assuming a 365 day per year operation and yearly maximum of 2540.4 pounds of lead according to the Virginia Department of Environmental Qualities Hazardous Waste Permit Writer in an email dated 1/26/16.

318 Jon Johnston, March 25 2016.

risk are interpreted as threatening by the polluters and regulators even as fenceline activists attempt to gather knowledge.<sup>319</sup>

Compounding these factors is general hesitancy of local experts affiliated with the local research university to investigate the matter. The difficulty in attracting experts from Virginia Tech to intervene stems from the university's historic and close-knit relationship with Radford Arsenal. For example, Al Giacco served as President of Hercules from 1977 until 1987 while also on the Board of Visitors of Virginia Tech from 1979 to 1987. He was rector of the board from 1984 to 1987.<sup>320</sup> Virginia Tech became a fenceline resident of Radford Arsenal when it acquired Kentland Farm on December 31, 1986 in a land trade with developers for the experimental agricultural station in Christiansburg, Virginia.<sup>321</sup> Giacco was in a leadership position during this period at both the Radford Arsenal and at Virginia Tech.<sup>322</sup>

There is considerable resistance in mobilizing university experts to study the facility, however, open burning was studied by James Phipps a former student at Virginia Tech. Phipps modeled open burning of NOSIH AA-2 sheet waste propellant in a 1997 master's thesis submitted to the faculty of Virginia Tech's Environmental Engineering Department. The analysis does not rely on ambient air quality monitoring yet, "...exposes limitations in the model in the plume height calculations and the sampling time method."<sup>323</sup> *Air Assessment of Open Burning at Radford Army Ammunition Plant* modeled peacetime waste production not wartime conditions from the beginning and execution of the longest war in United States' history.<sup>324</sup>

For regulators and producers there is a stake in continuing the narrative of denial, not searching for information, and pretending that fenceline experiences do not exist, especially in context to the relocation of the diary in 2015 to the fenceline.<sup>325</sup> However, after repeated concerns and requests by other community members and myself the university conducted a onetime test for contamination in the wells of Kentland Farm.

The university hired Blacksburg based Draper Aden and Associates. Draper Aden is the same local civil and environmental engineering firm that has conducted many studies for the producers of Radford Arsenal. Draper Aden Inc. tested the experimental agricultural station wells

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319 The structure of the public meeting is not conducive to for a dialogue, instead the meeting usually includes having the public presented to from either the US Army, Joint Munitions Command, BAE Systems, Virginia DEQ, US EPA, and a host of other agencies involved at the site.

320 Virginia Tech, "Alexander F. Giacco History of Virginia Tech " Virginia Tech, [https://www.unirel.vt.edu/history/administration/giacco\\_alexander\\_f.html](https://www.unirel.vt.edu/history/administration/giacco_alexander_f.html).

321 "Kentland Virginia Agricultural Experiment Station Virginia Tech," <http://www.vaes.vt.edu/college-farm/kentland/index.html>.

322 Alexander F. Giacco, *Maverick Management: Strategies for Success* (Newark: University of Delaware Press, 2003).

323 James F. Phipps, *Air Assessment of Open Burning at Radford Army Ammunition Plant* (1997).

324 See the dramatic increase in emissions from the 1990s juxtaposed to the 2000s after the wars started.

325 Virginia Tech's Police Department Chief Investigator contacted my father, a professor, at Virginia Tech about my activist social media posts discussing the open burning of lead and the relationship between lead exposure and violence. This had a chilling impact on my inquiry. I confronted many months of second guessing questions and persistent inquiry about the hazards and risk of open burning. This occurred on 8/6/15. Dairy Science scholars will not communicate with me, nor will anyone affiliated with Kentland Farm. In February 2016, I was told not to discuss the issue with anyone except for University Relations. A follow-up in June 2016 continued to confirm that I was only to talk to public relations of the university. I have since been banned from social media interaction with the Dairy Science Department.

for perchlorate and a host of other chemicals. The 3434 page report on 6 wells found perchlorate in highest level detected offsite wells at 1.6 ppb.<sup>326</sup> California has set a health goal of 1ppb of perchlorate in drinking water. While this is a low amount there is no plan for future tests. The lack of historical data on which to rely means we do not know how the levels might have changed over time. What were the levels in the irrigation wells in 2009 when the farm was opened on in 1987? In the laboratory conditions of the fenceline of Radford Arsenal what is the risk of 30 years of low level exposure to perchlorate or daily emissions from the open burns?

### ***Meta-Risk Analyses:***

While tolerable limits and maximum contaminant levels (mcls) focus on daily exposure they do not factor in the dimension of time into their toxicity index. What does 30 years of exposure to impartially combusted explosives and propellants do to the human body and environment? What does 30 years of constant rocket fuel exposure in drinking water due at very low levels? What is the effect of low level perchlorate exposure across generations? How are these risks defined and codified by production and regulatory experts for fenceline residents?

A FOIA request of the open burning ground permit is necessary to begin to understand the risk assumptions made by plant operators and regulators in public meetings that I attended over the period of three years: 2013-2016. Over and over again BAE Systems and US Army experts claim the language of risk mitigation by mobilizing the approved operating permit issued by the Virginia Department of Environmental Quality as evidence for safe operation and tolerable risk from acceptable levels of exposure.

The permit is a discursive text which legitimizes open burning hazardous waste as acceptable. The permit does not specifically mention the conditions of open burning as uncontrolled and prone to incomplete combustion. The issuance of the permit is the first thing regulatory experts point to when reassuring the public of the plant's safety in public meetings. Often experts will say "we/they are in compliant with all regulations as stipulated by our emissions and discharge permits." There is no discussion of any substantive argument on whether the practice is actually safe or what compliance means? Producers and regulatory experts do not mention the risks associated with constant exposure to incompletely combusted explosives. There is no mention of particulates drifting over communities due to the fact that temperature, oxygen content, and turbulence of the material cannot be controlled by the very primitive nature of the practice technology of open burning.

Through analysis of the permit, I became aware of two risk assessments that inform operator and regulatory approaches to the safety of uncontrolled open combustion of toxic waste energetic material. These texts form the intertextual web of safety assurances that function as official regulatory expert discourse in the management of risk from open burning at Radford Arsenal. The *Screening Level Ecological Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant* (SLERA) and the *Human Health Risk Assessment for the Open Burning ground, Radford Army Ammunition Plant* (HHRA) embed assumptions about the fenceline through abstract modeling of exposure and risk.

An analysis of risk analyses is a crucial domain for practitioners of scholar-activist environmental justice research. We can familiarize ourselves with expert discourses of risk to

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326 Draper Aden Associates.

strategize intervention. Understanding the contestations over risk, tolerable limits of exposure, and pathway migration, within risk assessment and permits discourse, contributes to understanding the knowledge claims that the dominant discourse uses to reproduce production in and along hazardous fenceline sites.

These risk assessments embed complex assumptions about the relationships between land, soil, air, water, environment, and humans. They contain models assembled about the experience of everyday life on the fenceline. For example, the 2013 Open Burning Ground Permit states, “subsistence farmer scenario is a land use unlikely to be present within the study area.”<sup>327</sup> In fact subsistence farming does take place in the area. Many residents plant gardens and raise livestock to supplement their incomes, relying on local agriculture. Other residents use the river to supplement their diets with fish. Children often swim in the water just downstream from the plant’s outfall. Lots of fishing occurs on the New River downstream from RAAP. There is a public boat landing at Whitethorn just across from the Arsenal and downstream from the Main Manufacturing Area a few hundred yards from the agricultural station.<sup>328</sup> On any given day there are many fishing boats within 1 mile of the open burning ground. The Open Burning Ground was cited in 1994 as to close to a navigable waterway but given a special exemption to continue to operate.<sup>329</sup>

The risk assessments do not mention the presence of active commercial farming operations at Virginia Tech’s Kentland Farm.<sup>330</sup> The Dining Services Farm began in 2009 as a quarter acre herb plot expanding every year since. The agricultural facility has grown. I have eaten broccoli and other crops in the summer and autumn months at Dining Services. On July 17<sup>th</sup>, 2015 Virginia Tech’s College of Agriculture and Life Sciences’ Department of Dairy Science relocated to Kentland farm after generations at their former central campus locations to make way for a new interchange off the major US 460 Highway at Southgate Drive.<sup>331</sup>

Dairy production is currently active. The Dairy Science Department website has a list of FAQs, plan developments, and pictures celebrating the move to the fenceline.<sup>332</sup> Virginia Tech maintains a commercial farm with over 500 dairy cattle, beef cattle, and other animals on the fenceline of RAAP. During this time there was no reevaluation of risk even though changes on the fenceline occur every day as new wells, residences, businesses, and farms were constructed or returned to use. These risk assessments do not mention commercial farming operations in the

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327 See table of figures for this page of the Open Burning Ground Permit.

328 I observed 4 boats trailers and fisherman in the river in May of 2015 and February of 2016 during my time spent downstream of the site.

329 "Environmental Agreement between Alliant Techsystems Inc. And Hercules Incorporated," (1994).

330 One activist account speculated that the lack of assessment by the Virginia Department of Environmental Quality classification of the farm as a research area and is therefore an experimental facility exempt from the classifications a commercial producing farm would be subject in DEQ risk assessment protocol.

331 Virginia Tech, "Dining Services Farm at Kentland | Dining Services | Virginia Tech," [http://www.dining.vt.edu/sustainability/kentland\\_farm/](http://www.dining.vt.edu/sustainability/kentland_farm/). See figures for a picture of the destruction of the central campus facilities in spring 2016.

332 These documents are valuable and shed light onto the institutional framework that the University uses to justify the move. There is FAQ about if there is enough available water for 250 head of cattle at Kentland Farm. The response says there is and they are exploring the development of an additional well. This well would be located extremely close to identified groundwater contamination in the ATSDR report of 2014. See: Virginia Tech College of Agriculture and Life Sciences, "Dairy Relocation Information: Frequently Asked Questions," <http://www.cals.vt.edu/about/dairy-relocation/faqs/faq.html>. See: table of figures for a picture showing the demolition of the central campus dairy facility.

fenceline area. The modified 2013 open burning ground permit failed to recognize that fenceline conditions changed and evolved. It still does not account for the farm.

Discharge permits and risk assumptions contain normative commitments about land use and peoples' relationships to the land that would be better known if the knowledge and expertise of the fenceline standpoint was brought to the situation. This analysis shows a meta-analysis of regulatory risk assessments can help fenceline members develop their own expertise and knowledge at the intersection of plant expertise by showing how their lives are quantified in official risk assessments.

The process of inclusion and exclusion of data in a risk assessment is strategic. The choices of regulatory and production experts are the sites of contestation in the construction of ignorance and risk.<sup>333</sup> For example, Black Mesa's coal slurry line illustrated how risk associated with an industrial activity is socially constructed and dependent on stakeholder position. Risk assessments include certain variables and factors while excluding others. The politics of knowledge of how risk is constructed occurs by decisions over the inclusion/exclusion of information and data. These judgements have ramifications for quantifying fenceline exposure to toxicity. That which is deemed not pertinent to the quantification of risk is equally important to information not mobilized to construct the safety and legitimacy of the operation that a permit and risk assessment informs.<sup>334</sup>

At Radford, fenceline community members do not know what is in their water and air since war production increased dramatically after the launching of the wars in 2001 and 2003. RAAP officials and regulators continue to claim safety despite EPA risk and emissions data. The obvious lack of accounting for change on the fenceline further jeopardizes fenceline community members' health. A DEQ statement about risk assessments assumptions states, "DEQ appreciates your concern regarding air emissions from the OBG operations at RAAP. The 2005 Human Health Risk Assessment (HHRA) from CH2Mhill which you referenced explains the conservative approach that was used. The 2005 HHRA purposefully overestimated the impacts from the OBG operations to develop enforceable throughput limits to ensure that even in the worst-case modeled scenario the  $1 \times 10^{-5}$  lifetime cancer risk performance standard would be achieved."<sup>335</sup> This conservative approach did not plan for increased population density around the facility, the construction of commercial farm operations, the use of Radford Arsenal drinking water supply for the surrounding Prices Fork community in the early 2000s, or the increased reliance of community members on local agricultural production in the wake of the 2008 financial crisis. No specification of how the DEQ calculates these numbers has been furnished for various chemicals. The notion of a cancer risk performance standard quantifies fenceline life and implies the concept of a tolerable cancer allowance without any health studies, well, or air monitoring to adjudicate the actual impacts of the allowed emissions.

According to the United States' EPA's 2014 Risk-Screening Environmental Indicators (RSEI) Model, Radford Arsenal, BAE Systems component is the fourth riskiest facility in the nation according to Cancer Hazard, while ATK's New River Energetics is eighth.<sup>336</sup> According to the 2014 RSEI's Hazard Score BAE is fourth and NRE is third in the nation, yet regulators and

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333 See prior section on constructed and willful ignorance.

334 Ludwik Fleck, *Genesis and Development of a Scientific Fact* (Chicago: University of Chicago Press, 1979).

335 Virginia Department of Environmental Quality, 6/14 2016.

336 United States Environmental Protection Agency, "Risk-Screening Environmental Indicators (RSEI) Model," <http://www.epa.gov/rsei>.

producers claim that the plant is safe and does not pose a threat to the fenceline community.<sup>337</sup> To manipulate data two facilities are collocated at the same place and report two sets of toxic release inventory data with two unique RSEI reports. According to the Environmental Patriots, New River Energetics was removed from RAAP's Title V air emission permit in 2012. Taking NRE out manipulated the data to make RAAP's TRI reporting look better. To get a more accurate picture of emissions data combining both RAAP and NRE's toxic release inventory and RSEI data shows the full extent of the emissions from this site.

The RSEI is specifically created to help fenceline residents understand their fenceline in relation to other facilities across the country. Facility experts will claim this index is not reliable in spite of the fact that the EPA created these tools to assist fencelines. Regulators who deny the explanatory power of their agency tools creates uncertainty and unknowns about the indicators that exist to help fenceline residents understand their risk. Regulatory experts who work with the RSEI champion its effectiveness in gauging a facility's risk to the community. A similar denial of the TRI data is also mobilized in public meetings by regulators who delegitimize the tools created by their own agencies. These tools were created for fenceline residents to understand toxic releases and risk in and around their fenceline community.

Virginia Tech is growing food next to some of the most dangerous facilities in the nation without adequate human health risk assessment. However, DEQ and producers will claim everything is known and nothing is uncertain even though the risk assessments do not account for an active commercial farm. The RSEI overall score shows that Radford Arsenal's BAE component was number tenth in the country, while Alliant Tech Systems New River Energetics is 34<sup>th</sup> in the country in 2014.<sup>338</sup>

From a survey of the risk assessments there is no mention of the elementary and pre-schools downwind, dairy facility, Kentland farming operations, or children playing soccer on the base property. This lack of information contrasts with the official discourse of the Human Health Risk Assessment. The risk assessment states, "This HHRA evaluate risk associated with continued operations at the Open Burning Ground. The purpose for risk assessment was to evaluate potential risk to human receptors from ongoing facility operations so that measures can be taken to reduce identifiable risks, if needed, to acceptable levels through modifications of burning practices."<sup>339</sup> There is no discussion of preschoolers eating dirt on the playground 1.5 miles down wind at Belview Elementary School. While the operation of food production was not in place at the time of the 2005 assessment there is no requirement for an assessment update when fenceline conditions change even when the open burning ground permit was modified in 2013. Risk assessments are only conducted if DEQ requests it to be done during a permit application.

While the HHRA evaluated risk for a residential receptor at an offsite location for an individual at 300 meters it does not account for the distances that fenceline residents have reported seeing plumes of incompletely combusted energetic material. The HHRA claims:

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337 See RSEI data in the figures section.

338 United States Environmental Protection Agency, "Risk-Screening Environmental Indicators (RSEI) Model". Please download the EASY RSEI database for Microsoft Access and consult the 2014 data.

339 CH2MHILL, "Human Health Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," (2005), 4.



....[it] evaluated potential current/future risks for a residential receptor at the offsite location where air dispersion modeling projected that the highest concentration in air would occur. An individual was assumed to be located approximately 300 meters east of the facility fence line and potentially exposed through inhalation, incidental soil ingestion, fish ingestion (from the New River), and ingestion of home-grown fruits and vegetables. Two different emissions scenarios were evaluated in the HHRA using this exposure methodology.<sup>340</sup>

Rather than look at commercial farming operations, the downwind effects on Belview or Prices Fork Elementary Schools, the HHRA was dependent on assuming that agriculture would be limited to individuals and not mass-produced and sold to consumers. One scenario that the HHRA evaluated was for a propellant burn and skid burn. In both cases the HHRA claims that the estimated risks are below the required lifetime cancer risk of  $1 \times 10^{-5}$  and a non-cancer HI of 0.25 for residential and subsistence fisher scenarios.<sup>341</sup> The report concludes that "Potential lead exposures associated with these burning scenarios fall below regulatory thresholds. Acute inhalation exposures of chemicals potential emitted from the Open Burning Ground fall below their respective protective levels in air."<sup>342</sup> The notion of a regulatory threshold for lead exposure or DNT exposure runs counter to the increasing scientific knowledge of toxicity that looks at how any exposure is dangerous.<sup>343</sup>

Furthermore, this exposure risk scenario does not include the possibility that the contractors would place too much lead into the burn pile as they did in 2015 or too much chromium in 2012.<sup>344</sup> In fact in 2008, the New River Valley Health District found elevated blood lead levels at almost 3 times the state average in children with Radford zip codes.<sup>345</sup> Many people who live downwind from the open burning ground around Peppers Ferry Road have Radford zip codes.<sup>346</sup> Despite a warning that states too much chromium was open burned, there is no chromium release reported on the Toxic Release Inventory.

A 1976 Nuclear Power Plant Sitting Study conducted for the Radford Site specifically details the issues of any air emissions at the site stating:

It should be noted that the General Meteorological conditions in the vicinity of RAAP are poorly suited for locating thermal power plants. The ammunition plant is located in a broad valley surrounded by mountains of one thousand feet (1,000 ft) or more of relief which limit the horizontal movements of air masses. These topographic characteristics increase

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340 Ibid.

341 Ibid.

342 Ibid., 4-5.

343 Brian Salvatore, A., "Proposed Burn of M6 a Health Risk," Shreveport Times, <http://www.shreveporttimes.com/story/opinion/guest-columnists/2014/12/22/proposed-burn-health-risk/20782151/>.

344 Virginia Department of Environmental Quality, "Warning Letter: Permit Exceedance at the Open Burning Ground," ed. Blue Ridge Regional Office (April 3, 2015). "Warning Letter: Permit Exceedances at the Open Burning Ground," ed. Blue Ridge Regional Office (April 6, 2012).

345 Margaret O'Dell, "New River Community Health Digest," ed. Virginia Department of Health (2008), 32. See figures for the specific data.

346 The study of zip codes to identify how they impact data presentation is an important domain of fenceline environmental justice research. How facilities are assigned one zip code, but intersect another is important. How communities are distributed next to fencelines using a quantitative analysis would help to resolve our understandings of the concentrations of inequalities. Please see the table of figures for the 2008 data on blood lead levels in children.

the frequency of stable atmospheric conditions which, in turn, reduces the diffusion rates of plant emissions. Long, linear valleys (such as those in the vicinity of RAAP) limit the air mass movements to only two directions, up-valley and down-valley, and this subject, [sic] downwind population centers to greater doses than would be expected for sites without topographic extremes.<sup>347</sup>

The study determines that the locations south and east of the facility are the worst for downwind exposure to emissions. The report specifically finds fault with the use of meteorological data from Roanoke Airport to model conditions at the Radford site. The 1976 report concludes:

Because of the complexity of local effects in mountainous areas, meteorological data recorded at Roanoke should be used with caution and only for the purpose of defining regional climatic conditions. Actual site conditions, especially winds and stabilities, cannot be adequately determined from the existing data.<sup>348</sup>

Despite this government report from 40 years ago the Virginia DEQ still relies on a human health risk assessment for open burning that models meteorological data from Roanoke Airport. The report mentions considerable unknowns about the karst topography and groundwater. Little information is known about the specifics of karst hydrology and geology. Karst can act as an unpredictable conduit for contaminants to move offsite in the groundwater. The report calls for the further studying of the groundwater.

When we know so little about the complex hydro-geological conditions of this area how can ATSDR and DEQ reassure fenceline members that the contaminants in the groundwater are not moving offsite? The nuclear power plant siting study is a valuable discursive contradiction of much of the contemporary discourse about the safety of both air and water emissions at the plant found in the 2005 Human Health Risk Assessment and in the public discourse presented by officials in community meetings.

The assumptions in the human health risk assessment states that conservative estimates were made to ensure the safety of exposure to the surrounding community. However there is no verification procedure in the assessment or permit to actually track how the theoretical translates into practice. The definition of conservative is defined according to the specific terms and assumptions of exposure and toxicity based on the individual instead of the farm serving many individuals. The assessment generalizes generic conditions through the black boxing of previous scientific experiments and trials of exposure using computer models. The HHRA states, "The location where the highest concentrations in air, and highest deposition rate onto the soil, was used to estimate health risks associated with open burning operations. An individual was assumed to live at the maximum impact location, regardless of the actual distribution of populations surrounding the facility."<sup>349</sup> Conservative assumptions for fenceline residents ought to dictate rigorous verification of modeled exposure scenarios through real world monitoring.

While the HHRA focuses on risk to humans from exposure, the Screening Level Ecological Risk Assessment (SELRA) sought to:

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347 United Engineers, "Nuclear Power Plant Siting Study for Department of the Army," ed. Chief of Engineers Office (Washington, D.C.1976), 2-39-2-40.

348 Ibid., 2-69.

349 CH2MHILL, 5.

...evaluate potential risks to ecological receptors associated with the operation of the Open Burning Ground in support of a RCRA Part B, Subpart X permit application for the open burning at the site. The ERA evaluated the potential future ecological risks of burning-related chemicals in ecologically relevant media (air, surface water, sediment, and surface soil) as determined by air dispersion and deposition modeling.<sup>350</sup>

The objective of the SELRA was “to evaluate risks to ecological receptors from continued burning operations so that measure could be taken (if necessary) to reduce any identified risks to acceptable levels through modifications to the design, engineering control, or other appropriate mechanisms.”<sup>351</sup> The objectives and goals of the risk assessments are portrayed through a discourse that normatively seeks to the reduce risk by predicting the rational and stable use of the open burning ground in the future.

Both the human health risk assessment and the ecological risk assessment adopts a worst case scenario outlook. For example the HHRA states:

One scenario representing a propellant burn (lasting approximately 5 minutes in duration). This represents a burn rate of 8,000 lbs per day, for 365 days/year; A second scenario representing a burn with higher non-energetic content (wooden skids, diesel oil, nonenergetic debris including metal debris, Teflon and HDPE screens), referred to as a skid burn. This burning scenario is assumed to be several hours in duration. This represents a burn rate of 2,000 lbs per day, for 365/year.<sup>352</sup>

The discourse that justifies present and future pollution uses a temporal language to evaluate long term future prospects of operations by assuming even and steady operation according to the above parameters. These assumptions illustrate one of the fundamentals of the solution to pollution is dilution paradigm. The risk assessments model tolerable exposure over time through the prediction of a stable and consistent future assuming rational operator use of the open burning ground without analyzing cumulative effects from other pollution sources in combination with emissions from the open burning ground.

The discourse embeds a notion of an acceptable future through evaluation of potential unforeseen interactions of open burning with the environment and society by postulating models and computer simulations without verification measures such as ambient air quality monitoring. A tolerable future is constructed through an appeal to the notion of an acceptable level of pollution or acceptable exposure limits within the confines of a stable and static model. This key discursive component of the solution to pollution is dilution paradigm fails to acknowledge the compounding effects of other environmental toxins and exposure from other sources in a rapid and dynamic model that responds to real world assessment and monitoring.

These exposure scenarios do not adjudicate for cumulative exposure over many years or misuse of the open burning ground like burning when the winds are too high as happened in March of 2016 when I observed a plume of orange smoke in front of my house.<sup>353</sup> HHRA scenarios do not evaluate scenarios for of downwind habitation of the area such as the life I have lived around

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350 "Screening Level Ecological Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," (August, 2005): 1.

351 Ibid.

352 Ibid., 4.

353 See Figures section for photos, which Erin Brockovich shared on her Facebook page after I sent them to her.

this facility. Furthermore, the risk analyses do not consider the violations that have been found for burning excessive toxic material. Virginia DEQ has issued two “warning letters” to BAE for burning “too much” chromium and lead on 3 separate occasions, which have resulted in no action and an incomplete EPA Enforcement history. Warning letters are not reported the EPA’s national enforcement database.<sup>354</sup>

The discourse shows that the quantification of time and exposure pathways justify “safe” operations. These quantifications are based on appeals to other documents and models from simulated burns that do not account for the variety of material placed in the open burning ground identified in the multimedia inspection report issued by the US EPA in 2011 and National Investigations Enforcement Center’s 2014 report.<sup>355</sup> No mention of the variety of local topographical and metrological conditions is found in the assessments. The facility operator was found to be in probable violation of multiple environmental statutes in recent years with documented concerns in both the EPA’s 2011 and 2014 report. However, no enforcement action has occurred.<sup>356</sup>

The SELRA and HHRA performs a justification of operations by constructing acceptable and tolerable limits of exposure using expertise across many other documents and models that inform regulatory experts’ understanding of how pollution and risk interact from open burning. Forcibly this type of expertise omits an account of fenceline expertise and how residents understand and experience their risk from hazardous waste production and management at the Radford site.

Expert calculations conglomerate observations and findings from research studies that inscribe particular arrangements and interactions among society, environment, and the operation of the open burning ground around fenceline residents.<sup>357</sup> The use of the word “future ecological risks” of burning related chemicals in context to an elaborate network of assumptions regarding wildlife, gardens, forests, plants, and how people live with and interact with nature normatively constructs safety in the midst of the laboratory experiment of open burning. Open burning practices are constructed according to exposure simulations that define limits within tolerable levels which rely heavily upon many assumptions about an infinitely complex nature and society with many complex variables.<sup>358</sup>

There is no mention to specific types of materials going into the burn. Instead each chemical is compartmentalized into elements and molecules. There is no analysis of how the chemicals interact when incompletely combusted in the presence of a variety of meteorological

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354 Virginia Department of Environmental Quality, "Warning Letter: Permit Exceedance at the Open Burning Ground." "Warning Letter: Permit Exceedances at the Open Burning Ground."

355 See discussion of the POLU13 Combustion Model in CH2MHILL, "Screening Level Ecological Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," 5.

356 There has been allegations that EPA’s Office of Homeland Security is interfering with the ability of the EPA’s Inspector General’s Office to conduct investigations. Josh Hicks, "Inspector General Accuses Tiny EPA Office of Blocking Oversight Efforts (Posted 2014-05-08 03:30:31)," *The Washington Post* 2014.

357 CH2MHILL, "Screening Level Ecological Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," 3. The SELRA states, “Standard Models from the literature are used to estimate chemical concentrations in air, surface soil, surface water, sediment, and biological tissues (for use in direct and or food web exposure modeling) (see Section 4).”

358 Ibid. For example, “Data from air dispersion and deposition modeling are used to estimate ecological exposure for continued operation of the Open Burning Ground (assuming an additional 40-year active life).”

conditions or with other chemicals moving through the air and the ignition point from off-site. Instead the Human Health Risk Assessment uses meteorological modeling from the Roanoke Regional Airport over 30 miles away in an entirely region at much lower elevation with substantially different meteorological conditions including inversion conditions.<sup>359</sup> There is no mention of snow being blown over and onto the burn pans, coming into contact with toxic residues, and drifting onto the surface water which will be used for drinking water in towns downstream.

These assessments do not assess risks from pulling drinking water from the middle of the horseshoe bend next to the open burning ground and supplying Prices Fork Elementary in the Prices Fork area of Montgomery County when the municipal wells were condemned.<sup>360</sup> There is no mention of fisherman travelling down the river after a burn stopping to eat lunch in front of SWMU 13 on the river next to the OBG as I have done three times throughout my various canoe trips through the arsenal. There are no posted warning signs that the land is contaminated.

Expert generalizations of what types of chemical constituents might be present in the burn are prepared according to the classification of chemicals of concern on conservative assumptions. The meaning of the term conservative makes the assessment seem robust, but is a discursive technique to legitimize continued open burning. Conservative risk assumptions do not include fenceline knowledge gained through the lived experience of fenceline residents, nor do they contain any verification or falsification measures through actual monitoring and study. How conservative is conservative enough when you open burn hazardous explosive waste?

For example, The SELRA states, “Conservative assumptions were used to address uncertainties in the risk assessment process. In general, the largest possible list of constituents potentially associated with waste streams at the Open Burning Ground, and the highest emissions factors of those constituents, were used to estimate impacts from open burning operations.”<sup>361</sup> The use of the term ‘conservative estimate’ suggests prudent accounting of all possible risks to the ecology and human health from operations at the burning ground. I argue the idea of a conservative approach differs significantly from real-world operations evident by the issues found in the EPA inspection report of 2011 and 2014 and the lived experiences of fenceline community members who have experienced plumes moving over their homes and schools.<sup>362</sup>

Esoteric risk assessments obfuscate public participation. Assessments rely on a vast web of expertise, across intertextual documents, codes of regulation, models, and simulations that frame the open burning ground in reference to other activities associated with hazardous waste management like incineration. Incineration is a completely different process than open burning. This places the burden of proof on fenceline residents to prove that an activity is unsafe instead of on operators to prove that the activity is safe. Radford does not have to verify its claims in the risk assessments, but fenceline residents are expected to prove that their claims of harm are indeed true. This is an impossible task without the aid of lawyers, scientists, technology, and doctors.

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359 See Figure 3-9 in the "Human Health Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant."

360 Dave Ratcliff, "Alliant Radford AAP to Provide Water to Montgomery County, VA," in *News@Arms*, ed. Operation Enterprise: A National Cooperative (Summer 2003).

361 CH2MHILL, "Human Health Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," 5.

362 Discussions on these experiences will follow in the next chapters.

The division of chemical components from whole material to the elemental and molecular constitution gives only a simulation for the real world operation of the open burning ground according to previously identified toxins. There remains great uncertainty as to tolerable limits during a hazardous waste management process that relies on dousing hazardous waste in diesel fuel to ignite and disperse the material when conditions are not necessarily as generalizable as the risk assessments and permits assume.

The notion of safe limits and tolerable risk recalls the nuclear age and the quest to find a biological dosimeter for the tolerance dose of radiation that humans can safely withstand.<sup>363</sup> Ultimately, no dose of radiation is safe, though at the time of atmospheric nuclear testing there was considerable effort to find tolerable limits of radiation exposure to justify nuclear safety in the face of many unknown risks. The list of compounds considered in the Human Health Risk Assessment for the open burning ground is based upon a Human Health Risk Assessment Protocol conducted in 1998 by the US EPA for the purposes of evaluating risk for incinerators.

STS has a long history of showing how knowledge and science change, yet risk assessments operate in a vacuum of the rich account of scientific progress and knowledge evolution in our field. The 1998 protocol deals specifically with incineration and guidelines for evaluating risk from incinerators, not open burning grounds. The compounds of concern considered for the HHRA for the open burning ground relies upon this document. The 1998 Human Health Risk Assessment Protocol is cited in the 2005 Human Health Risk Assessment. All compounds identified in the HHRA and in the Waste Analysis Plan (WAP) for Radford were selected for compounds of potential concern status for the open burning ground. The waste analysis plan is found in the permit for open burning that expired on October 15, 2015. There is a considerable lack of account for knowledge evolution in these texts guiding regulatory decision making.

In September of 2016, open burning operations continue under an expired permit. When a permit expires what is known as a shielding process kicks in. Shielding allows operations to continue so long as a renewal application is submitted prior to the expiration of the permit. This means that operations can continue indefinitely while a permit is crafted by regulatory officials. Shielding allows for continued operations even when it may take years to design a new permit due to the negotiations that are made with community members, the scientific community, plant experts, state and federal regulators, and policy experts. Despite an effort by EPNRV to collect 300 signatures to petition DEQ to hold a public meeting about the permit renewal, no meeting is scheduled for at least another 6 months to a year.

The web like structure of these interlocking expert narratives and the intertextuality of these documents legitimize a network of regulatory expertise that protects producers. Expertise with a normative commitment to continuing operations emanates from production and regulatory experts across the fenceline from a variety of institutions including regulators, contractors, and operators. Regulatory and producer expertise is centered on a number of converging texts that make reference to one another to establish a web of support for continued open burning as a tolerable risk to the fenceline community. The discourse of safety, found in the risk assessments, is grounded in other quantified data from a divergent network of authority from laboratories and previous experiments

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363 United States.

simulating incineration of compounds of concern in context to the practice of open burning. These are the inscription devices justifying the black box of open burning safety risk analyses.<sup>364</sup>

For example, the SELRA and HHRA makes use of many in-depth analysis of the models such as the POLU13 combustion and simulations in the bang box which inform the Open Burning Open Detonation Model (OBODM). The network of institutional discourse relies on information presented in the stack testing report for the incinerator (FEG 2001c) and the HHRA for the incinerator (FEG 2001a).<sup>365</sup>

The notion of modeling open burning from incinerator data is fundamentally unsound. The SELRA states, "Risk estimates were calculated for each receptor, across all applicable exposure pathways, and summed to obtain an estimate of total risk for each receptor. All risk calculations were found to be below benchmark values for each habitat. Therefore, incremental emissions of selected chemicals of potential concern (COPCs) from incinerator operations were considered unlikely to result in adverse environmental effects."<sup>366</sup> The risk assessment for the incinerator is applied to the open burning ground as if the technologies of waste disposal are the same and meteorological conditions do not change despite the lack of control inherent in any open burning operation.

This shows how the homogenization of techniques compartmentalizes, not only technologies, but also the lives of fenceline residents. Open burning and incineration are treated as the same. The idea that incineration is similar to open burning is preposterous. Such an equation demonstrates the quantification of my life as a fenceline resident living next to an open burning ground by the power of experts to make apples appear as oranges.

Homogenization is itself political. For example, when fenceline residents point out that at Camp Minden, Louisiana open burning was deemed unsafe and alternatives were implemented, Radford production and regulatory experts accuse fenceline residents of comparing apples to oranges. The ability to control the discourse is a function of power and its exercise on the politics of knowledge and risk on the fenceline.

### ***Surviving Open Burning Quantification, New Directions:***

Ulrich Beck, author of *Risk Society*, defines risk as "... as the probabilities of physical harm due to given technological or other processes. Hence technical experts are given pole position to define agendas and impose bounding premises *a priori* of risk discourses."<sup>367</sup> We see the technical experts at the plant; Alicia Grey, Luis Ortiz, Rob Davie, and Charlie Saks, presenting and defining

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364 Latour.

365 An entire book could be written on the construction of these models. We as STS scholars should encourage research into how these models are constructed and the normative comments made in the modeling of air pollution just as Bijker and Wiebe analyzed the emergence of particular forms of technology or how historians of science have looked at controversies like the Great Devonian Controversy. Waste stream information published in the literature (Bjorklund et al. 1998; Mitchell and Suggs 1998) were used as an alternative basis for estimating emissions from the Open Burning Ground. A published database or emission factors applicable to the open burning and open detonation practices had been developed by the Dugway Proving ground (Mitchell and Suggs 1998). See page 5 of the SELRA.

366 CH2MHILL, "Screening Level Ecological Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant," 3.

367 Beck, 4.

agendas by imposing bounding premises and promises about the safety of the open burning ground during public meetings.

Alicia Grey was BAE System's Communications Specialist for both the Radford Army Ammunition Plant and the Holsten Army Ammunition Plant. She was not present at the September 24, 2015 public meeting and is in a different position with BAE at a different location. Luis Ortiz was the commander of the Radford Arsenal from June 11, 2013 till June 12, 2015.<sup>368</sup> Rob Davie is listed as the Chief, Operations Team, of the US Army at RAAP on the May 8, 2014 public meeting power point. Charlie Saks also listed as the Public Affairs officer for US Army.<sup>369</sup>

These four persons are the technical experts who interacted with fenceline members during this research. They serve as the points of contact with the public and disseminate knowledge and expertise from behind the scenes agents, models, interlinking texts, and discourses of control and safety through acceptable levels and risk mitigation.<sup>370</sup>

Regulatory and production experts are given a position of power to define agendas and impose bounding constraints on risk assessments as Beck theorizes. In four public meetings, over two years, these figures all pointed to the risk assessments that were part of the permit application for the open burning ground permit application. They exerted a hegemonic position as regulatory and production experts through their power to defining risk. Beck states:

A small group of sociologists and anthropologists from beyond the cultural pale of this hegemony have made three observations in particular. First, such physical risks are always created and effected in social systems, for example by organizations and institutions which are supposed to manage and control the risky activity. Second, the magnitude of the physical risks is therefore a direct function of the quality of social relationships and processes. Third, the primary risk, even for the most technically intensive activities (indeed perhaps most especially for them), is therefore that of social dependency on institutions and actors who may well be- and arguably are increasingly-alien, obscure and inaccessible to most people affected by the risks in question.<sup>371</sup>

The foreign status of knowledge and dependency on regulatory and production experts that fenceline community members encounter in their interactions with industrial polluters and regulators is produced by the esoteric nature of the risk assessment and the intertextual relationships among many esoteric texts.

As illustrated, these assessments are detached and abstracted from their experience and are often inaccessible due to the complexity in how experts, with a stake in production, create narratives of the safe management of risk using technical language built across many esoteric texts. Beck's formulation illustrates the sociological origins and processes that create and sustain risk

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368 Orlando Salinas, "Radford Arsenal Gets New Commander," WDBJ&, [http://articles.wdbj7.com/2013-06-11/radford-army-ammunition-plant\\_39905595](http://articles.wdbj7.com/2013-06-11/radford-army-ammunition-plant_39905595). Robby Karth, "New Arsenal Commander Takes Reins, Will Face Similar Challenges as Past Leaders: Environmental Issues, Including Upcoming Burn Permit, Remain an Ongoing Situation at the Facility," Roanoke Times, [http://www.roanoke.com/news/new-arsenal-commander-takes-reins-will-face-similar-challenges-as/article\\_e7e221f3-b2e0-5463-bf5c-455ab099b25c.html](http://www.roanoke.com/news/new-arsenal-commander-takes-reins-will-face-similar-challenges-as/article_e7e221f3-b2e0-5463-bf5c-455ab099b25c.html).

369 BAE Systems and US Army, Team Radford Semi-Annual Meeting vol. 2014 (USA2014).

370 Access to production experts, both retired and in current position, was very difficult after repeated requests to plant officials.

371 Beck, 4.



adjudications vis-à-vis technical experts and their discursive interactions with fenceline community members. I have shown that fenceline communities can engage in resistance through the exercise of critical discourse analysis in conjunction with the methods Beck develops in *Risk Society* to situate what it means to live in a risk society. I illustrated how this can be done in the analysis of the risk assessments using fenceline expertise and knowledge.

Beck's work contributes significantly to our understanding of how risk is produced as a sociological process at the nexus of science, technology, economics, and production, yet it lacks a fundamental notion of the understanding of power in postmodern discourse theory. Namely, that power is not merely exerted top-down, but rather is constituted through a web of social interaction. A web like understanding of power, critical discourse analysis, in conjunction with Beck's analysis of risk, allows for a more nuanced understanding and intervention strategy into the process of risk construction. Fenceline residents can intervene and become experts influencing risk calculations.<sup>372</sup> By conceptualizing power in web-like form it allows us to theorize a strategy of intervention as fenceline experts. We can imagine the role that fenceline communities can play in challenging the discourse of experts about risk in their localities to better the conduct of knowledge about the experiments of risk on the fenceline.

Theorizing power in a network, moving in capillary-web like motion, broadens our notion of the construction of risk. I have built an account of current risk analyses and discourse at Radford Arsenal's open burning ground as inadequate. I also strategize and demonstrate intervention toward increasing public participation by challenging existing hazardous waste management techniques to show that the fenceline standpoint can exert power in decision making processes; usually theorized as emanating from the top down from plant officials.

In fact scholar-activist actions by myself and the Environmental Patriots of the New River Valley have reframed the discourse about open burning of the hazardous waste near the community to the point that the university has now designated a public relations person to handle scientific knowledge inquiries about issues related to the farm.

Michel Foucault in *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977* offers powerful insight into the composition of power in society. Foucault states:

Power must be analyzed as something which circulates, or rather as something which circulates, or rather as something which only functions in the form of a chain. It is never localized here or there, never in anybody's hands, never appropriated as a commodity or piece of wealth. Power is employed and exercised through a net-like organization.<sup>373</sup>

Foucault sees that discourse is central to the establishment of power relations. Permits for hazardous waste discharge and the risk assessments which justify safe operations at permitted levels are discursive exercises of power that have direct consequences for residents in fenceline communities. Beck's theory of risk, in conjunction with Foucault's analysis of power, helps scholars understand how central discourse is to the exercise of power in the form of pollution permits and risk analyses. Such a conceptualization allows environmental justice researchers to strategize for intervention. I suggest that by examining the discourse of risk in regulatory documents fenceline residents can understand the operations of power and locate points of

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372 Teun A. van Dijk, "Principles of Critical Discourse Analysis," *Discourse Society* 4, no. 2 (1993).

373 Foucault and Gordon, 98.

intervention to normatively pursue goals like reduced emissions, increased efficiency, redefinitions of risk, and technical fixes. The third case of this dissertation at Camp Minden illustrates a success in finding alternatives to open burning through grassroots fenceline organizing and empowerment.

Analyzing risk assessments and permits discursively reveals the textual enactment of power relations through the specific conceptions of the relationships between the environment, society, and production in context to a risky fenceline production. Understanding how risk is constructed by questioning risk assumptions offers key nodes of intervention for fenceline community members in dissecting the risk calculations made about their lives by regulators and operators.

Risk calculations are discursive. Michel Foucault states: “What I mean is this: in a society such as ours, but basically in any society, there are manifold relations of power which permeate, characterize and constitute the social body, and these relations of power cannot themselves be established, consolidated nor implemented without the production, accumulation, circulation and functioning of a discourse.”<sup>374</sup> Thus, to understand the relationships of power at stake in fenceline communities one can look at the permitted discharges and risk assessments as discursive embodiments of power. These power exercises inform the construction of safety, tolerance, acceptable levels of exposure and risk. Risk discourse is conceptualized in arrangements of power which promotes the continued operation of production. Together risk adjudications are presented as black boxes in a language of control and prediction despite knowledge deficits and uncertainty.<sup>375</sup>

### ***Conclusion: Radford as a Future Beginning: New Directions in Fenceline Scholarship:***

This chapter contributes to a deficit in STS research about active military industrial facilities by offering insights to other scholars working at the intersection of the military-industrial pollution and risk. I suggest how fenceline communities can empower and intervene to more fully participate in the politics of knowledge and risk at stake on the fenceline through Critical Risk Analysis. Foucault describes the beginnings of such a project devoted to reactivation of local knowledges in order to struggle against the coercion of a theoretical, unitary, formal and scientific discourse. He asserts:

By comparison, then, and in contrast to the various projects which aim to inscribe knowledge in the hierarchical order of power associated with science, a genealogy should be seen as a kind of attempt to emancipate historical knowledges from that subjection, to render them, that is capable of opposition and of struggle against the coercion of a theoretical, unitary, formal and scientific discourse. It is based on the reactivation of local knowledges--- of minor knowledges, as Deleuze might call them—in opposition to the

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374 Ibid., 93.

375 See the work of Latour. Blackboxing refers to how “Once a large number of earlier arguments have become incorporated into a black box, the cost of raising alternatives to them becomes prohibitive” (242). Black-boxing is made possible through the supply of credibility in that they have so much credibility that they reify everything as accepted “so as to increase the cost of raising objections.” Latour uses the example of the mass spectrometer whose results are accepted as fact and not questioned by scientists working with it i.e. the basic assumptions of what constitutes a mass spectrometer are considered settled and stable facts, not open to debate or range of acceptable discourses within the frameworks of knowledge scientists deploy (243).

scientific hierarchisation of knowledges and the effects intrinsic to their power: this, then is the project of these disordered and fragmentary genealogies.<sup>376</sup>

Quite often discussions with plant officials and experts revolved around theoretical and formal risk analysis. Risk is defined in terms like permitted limits, tolerable exposure thresholds, waste reduction plans, DEQ conclusions, and vague computer simulation data instead fenceline knowledge. Fenceline knowledge and expertise contributes to understanding change on the fenceline through local based empirical observations of smells, plume sightings, air quality monitoring, water, soil or crop testing.

I deployed first-person scholar-activist methods to offer a model of inquiry by activating fenceline knowledge and expertise. I built a case for fenceline expertise which aspires to empower community involvement, proactive research, and risk mitigation as normative commitments for environmental justice research based on the fenceline standpoint. I articulated how fenceline knowledge can contribute insight into developing critiques to the solution to pollution as dilution model of tolerable risk at the fenceline. I call into question the sufficiency of existing risk analyses at the open burning ground at Radford Arsenal by reconceptualizing risk using critical discourse analysis and my own standpoint drawing on my fenceline knowledge and activist-expertise. I point to new directions of research for scholar-activists to continue to intervene at the Radford site. Knowledge deficiencies in existing risk assessments can be challenged through a mapping of the fallout zone using further scientific and ethnographic study.<sup>377</sup>

A meta-risk analysis illustrates the processes in which power discursively sustains open burning operations at the Radford Arsenal. I show how open burning ground risk assessments contain standardized relationships of how human activity interacts with the environment. Specific relationships of cause and effect are assumed by risk analyses. Analyzing a risk assessment offers important discursive insight into how safety and risk are constructed. Through these analyses we can see the operation of power in and around a military industrial facility's open burning practices. I show that fenceline residents can contribute valuable insight into understanding the pollution of a plant in their community via contributions of observation and inquiry.

The arrival of new digital social media technologies have revolutionized activist communication and coalition building across global fenceline sites. The democratization and proliferation of information technology enables inquiry and sharing of information that previously would have been very difficult because of time and resource costs. The emergence of new technologies enable citizen science observation through the proliferation of digital recording devices, computers, smartphones, social media, and instant communication.

I was able to take a photo of an open burn plume moving over the fenceline using an I-phone. I emailed it to the celebrity environmental activist Erin Brockovich and it was shared over 3000 times reaching people all across the region helping to bring together a public meeting on April 2, 2016 with over 30 people from a variety of backgrounds to discuss the arsenal and open burning. The local news covered the issue in depth as result of the viral photograph and persistence

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376 Foucault and Gordon, 85.

377 This is outside the scope of this dissertation.

by the Environmental Patriots of the New River Valley helping to expose the practice of open burning.<sup>378</sup>

The increasing capabilities of computing systems combined with networks of solidarity and engagement between fenceline groups empowers fenceline citizens to record, document, and share their fenceline experience and knowledge of facilities. The affordability of video and image reproduction and rapid communication through social media platforms lowers the barrier of entry to sharing of information across fenceline sites. Citizens are increasingly able to monitor and document their environment and interactions with regulators and producers on the fenceline.

These tools equip fenceline residents with powerful means to create discursive representations of their experience with a facility on the fenceline. Fenceline residents can construct their own expertise through a reliance on outside experts and technologies by building solidarity with other groups in different fenceline. Solidarity between the Environmental Patriots and the Concerned Citizens of the Camp Minden M6 Open Burn has empowered Radford's fenceline to seek alternatives to open burning. These tools also allow fenceline residents to engage in a public relations campaign that previously was only available to those with significant resources.

Shared fenceline expertise, from an individual site, can be organized across fencelines to mobilize the benefits of an institutional structure (dissemination and momentum) for knowledge diffusion while simultaneously retaining the important contributions of local knowledge and narratives of struggle for environmental justice. Dissemination of shared stories, connection to other experts, and the documentation of empirical pollution and risk experience in fenceline communities can assist local communities in developing their expertise.

Having a research agenda that aims to compile, organize, categorize, and genealogically study risk assessments and in context to the fenceline standpoint can help to create more awareness among lay publics who live in fenceline communities. The formation of fenceline expertise and knowledge of a facility is now globally accessible. Fenceline knowledge about risk, methods of organizing, successes, and valuable learning moments in failure become available to divergent actors in many different fenceline situations through the sharing enabled by new technologies of communication. Knowledge creation and preservation can assist fenceline communities struggling with environmental justice by building an intertextual account of experience, releases, toxicity, and risk. These accounts are especially useful as knowledge evolves and politics change. This is an evolutionary approach that understands that risk shapes and is shaped by society.<sup>379</sup>

This chapter documents my fenceline experience while also suggesting new forms of resistance for fenceline members in order to reorient their experience and knowledge as epistemologically equal to regulatory and production expert categorization of their lives. The account is an experiment in telling sociotechnical history around a facility and the contemporary controversy of open burning military munitions. I detail the inadequacies of an existing risk

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378 Rachel Lucas, "WSLS 10 Investigates Pollution at the Radford Army Ammunition Plant," wsls, <http://wsls.com/2016/05/17/wsls-10-investigates-pollution-at-the-radford-army-ammunition-plant/>.

379 The internal combustion engine powered automobile addressed manure pollution in the cities where large concentration of horses and buggies existed prior to its introduction. Electric cars will replace the pollution of the internal combustion engine, but will present new problems unforeseen by the proponents of the technical fix.

assessment from a fenceline experience informed by fenceline expertise that originated in seeing how activists in the Black Mesa extraction zone operated to empower themselves.

Analyzing risk assessments contributes to fenceline awareness. Critical Risk Analysis helps to form a basis on which to address environmental justice in fenceline communities by empowering communities to understand how a polluter justifies its releases. This analysis is an important component to interdisciplinary environmental justice scholar-activist research in the 21<sup>st</sup> century. Fenceline residents living next to hazardous waste sites grapple with narratives of safety and risk in context to considerable uncertainty due to mistrust of experts and the epistemological devaluation of the standpoint of their knowledge and expertise. Plant experts operate a priori through a claim to “know” safe limits of emissions due to hegemonic claims of having the tools and experience to adjudicate the boundaries of safety. Regulatory experts are given the benefit of the doubt about how they claim a risky activity is safe. They are insulated from questions on the basis of their privilege to know and control a risk situation through their ability to appeal to the tools of esoteric risk assessments.

Plant and regulatory experts form one component expertise at Radford Arsenal. Traditional experts are plant managers, regulators, and other highly trained individuals who work to justify continued operation and tolerable risk. They appeal to networks of discursive expertise of institutional power and momentum.

A second level of expertise exists at the intersection of the facility, environment, and society around the fenceline. This is the category of the fenceline expert. Fenceline expertise belongs to locals who live in the fenceline areas who have knowledge of the local environment, experience pollution, and understand the dynamics of what occurs in their community’s interactions with a polluter. They draw their own expertise through observation of the activities of a polluter and their daily existence around a fenceline. Fenceline experts understand the experience of risk and pollution through their daily living around the sights, sounds, and smells of the fenceline.

Finally, a third category of expertise comprises the organization and collaboration of fenceline knowledge and expertise into institutions or affiliations of individuals that are shared with outside technical, legal, policy, and scientific experts. For example, the next chapter illustrates a case of successful resistance to open burning at the Louisiana Army Ammunition Plant. The successes at Camp Minden helped fenceline residents at Radford open new lines of questioning and develop tactics in their local opposition to open burning. The Ceasefire Campaign is an example of an institutional organization of fenceline experience and knowledge about open burning. Ceasefire, has produced white papers and information pamphlets about the conditions on the Radford fenceline.

As a fenceline resident, the collaboration and knowledge sharing enabled by the success of Camp Minden has profoundly shaped the struggle and discourse in Southwest, Virginia to end the practice of open burning. Outside expert intervention in one fenceline can directly impact another by sharing experiences and knowledge on the fenceline across fencelines. The coordination of the national Ceasefire Campaign is an institutional cooperation of many fenceline knowledge experts who are working to stop open burning in their local communities.

In conclusion, community members who wish to engage in dialogue with regulatory and production experts about the pollution of their fenceline facility need to understand the language

of expertise and vocabulary with which experts claim to safely assess risk. Familiarity with the assumptions on which risk analyses are grounded helps fenceline environmental justice advocates to gain insight into the logics of risk construction which legitimize pollution as an acceptable risk in one space, but not another. This chapter empirically shows how open burning risk is justified in one community, so as to contrast it with the developments explored in the next case.

While the open burning ground permit at RAAP is undergoing renewal recent developments in the M6 disposal controversy at Camp Minden, Louisiana, illustrates that alternatives are available and performing successfully. At the bequest of a citizen movement EPA Region 6 implemented alternative technology, implicitly admitting that open burning is not safe. The work of those concerned citizens on the Minden fenceline provided an example for fenceline activists across the nation. The interactions between Minden and Radford shows that fenceline expertise is crucial to challenging unsafe practices at the local level and even more empowered when organized across fenceline sites.

## **Chapter 4: Camp Minden: Fenceline Knowledge and Expertise Challenge Open Burning Paradigm**

### ***Introduction:***

Chapter Four builds upon the previous two cases by exploring a hazardous waste propellant/explosives open burn controversy following a disaster. The controversial case over propellant destruction at Camp Minden illustrates how the standpoint of fenceline knowledge, expertise, and activism succeeded in intervening at the nexus of risk and knowledge politics on the fenceline. The proposed open burn at Camp Minden sought to laboratorize the fenceline as a site of open burning, but activists, scientists, and concerned citizens fought back to implement the world's most advanced contained burn structure.

Camp Minden was known as the Louisiana Army Ammunition Plant prior to the cessation of active production in the early 1990s. Minden is a story of empowerment on the fenceline through the mobilization of fenceline activism and expertise. Building on the previous themes, Minden played an important role in implementing contained burn technology by challenging the dominant paradigm of how propellant waste is disposed in the United States.

The erosion of confidence in open burning is best symbolized by a letter from the Director of American Chemical Society's Office of Public Affairs questioning the continued use of the practice in other sites across the country. Minden is a critical case of fenceline opposition to open burning and success in finding alternatives.<sup>380</sup>

This chapter tells a story of risk and fenceline expertise intersect with science and technology around a controversial practice. Concerned citizens, some of whom live on the fenceline, created a social movement to oppose one technology in favor of another to successfully dispose of M6. Contained burn technology was deployed instead of open burning improperly stored explosives. Contained burn technology substantially reduces emissions of toxic material and reduces risk to the environment and human health.

Prior to the implementation of contained burn technology an explosion disaster impacted the fenceline, shaking homes, and sending a plume into the sky around communities. Unstable and improperly stored material necessitated the quick destruction of explosives to eliminate any further risk of harm. The explosives could not be transported offsite. Instead the situation required immediate onsite remediation. The proposal to open burn the material threatened residents as it would be a huge source of emissions into the surrounding community. The disaster made the fenceline aware of the situation. Fenceline residents organized, calling for alternatives. The controversy created conditions for an EPA sponsored community dialogue. The Camp Minden Dialogue sought to find an alternative to open burning in order to mitigate risk. The goal was to avoid another explosion of the material and safely address improper storage of the material by rendering it inert thus creating the least risk possible for fenceline communities.

At first the fenceline of Minden faced imminent implementation of open burning of M6 propellant, but concerned citizens on the fenceline rapidly mobilized to counter this risky, hazardous technology. Through protests and direct action, concerned citizens organized scientific and technological expertise. They juxtaposed alternatives such as gas phase chemical reduction,

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380 Dr. Thomas Connelly Jr and American Chemical Society, July 13, 2016.

supercritical water oxidation, and contained detonation chambers with ‘Hold, Test, and Release’ capability. These technologies substantially reduce the risk from explosives destruction. Unlike open burning they are safer and cleaner methods of explosives disposal.

Minden illustrates a success in soliciting the fenceline standpoint through public participation in the implementation of a much less risky solution. The two previous cases concerned exclusions and marginalization of fenceline knowledge and expertise through regulatory and production risk calculations. Residents faced abstractly quantified fenceline community risk from the initial disaster on the fenceline. However, this case represents a success to implement a sociotechnical fix to reduce fenceline risk. The retraction of a contract for open burning by the EPA and the subsequent decision to implement a contained burn chamber was reached through collaboration of stakeholders who achieved consensus using a community dialogue. The success in Minden in seeking out an alternative for open burning and efficaciously implementing it makes this case historic.

Events at Minden provide inspiration for deeper community organizing and activism at Radford and other open burning ground fencelines like the Holsten Army Ammunition Plant. Minden blazed the trail by successfully resisting open burning through calls for more efficient alternative technology. Minden’s success provided a concrete example to the community around Radford Arsenal on the many alternatives to open burning that can be implemented in 2016 while the plant maintained that open burning is necessary.

Direct action around the Radford fenceline has championed the successes at Camp Minden. Minden helped community organizing efforts across the country and is an inspiration to local activists in Southwest Virginia who are working for contained burn technology at Radford Arsenal. Developments in spring 2016 show a growing social movement to oppose the continued process upwind from Blacksburg, Christiansburg and Virginia Tech.<sup>381</sup> Finally, the Camp Minden Dialogue illustrates how public participation can work by bringing together a variety of stakeholders, experts, and activists to achieve results in the reduction of fenceline risk by to listening and respecting input from the fenceline.

The reason for examining events at Minden, instead of a host of other potential instances of nationwide open burning sites, stems from the success at Camp Minden to implement an alternative sociotechnical fix to the inefficient and risky method open burning of hazardous waste. Minden’s success stands in contrast to Radford’s longtime open burning stagnation, but there is growing momentum by fenceline activists to implement safer and cleaner technology.

This chapter chronicles the implementation of an alternative to open burning through the design and build of the contained burn system at Camp Minden. Minden lays the groundwork for the conclusion of this dissertation: that all three cases show how the study of the social epistemology of risk on the fenceline ought to elevate the importance of the standpoint of fenceline knowledge and expertise as fundamentally important within the politics of the construction of risk on the fenceline. Minden effectively challenged the hazardous waste disposal status quo by advocating for cleaner, safer, and better technology.

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381 The reasons for a success and a stagnation are numerous but too much to posit for this dissertation. Time and further developments may tell a different story eventually. It is important to not speculate on causalities for why we see one success in Minden but not in Radford. Open burning may be stopped in Radford in the near future. Continued community activism is helping to shape the discourse about open burning in the New River Valley. See: Ross.



The Concerned Citizens of the Camp Minden M6 Burn achieved the implementation of contained burn technology through robust public participation, effective social media deployment, and public relations management to pressure EPA into rescinding the open burn contract. Concerned citizens' efforts to secure the Camp Minden Dialogue to find alternative technology empirically illustrates the social construction of technological systems. Developments at Camp Minden exemplify one of the fundamental contributions of Science and Technology Studies. Thomas Hughes' argues in "Technological Momentum" in which "social development shapes and is shaped by technology."<sup>382</sup> Citizens were active in their demands and their demands were met; stabilized through the closure of contained burn technology now in operation at Minden. Fenceline citizens directly shaped technology, which is in turn making their fenceline a safer less risky place.

Events in the Ark-La-Tex region represent a turning point in national discourse about open burning as an acceptable means of treatment of hazardous waste. From this high profile case the national Ceasefire Campaign was launched and organized by the Citizens for Safe Water around Badger, Radford's sister plant, to organize local groups into a national coalition seeking to end open burning.<sup>383</sup> The national campaign is working to end open burning in the United States through a coalition of 46 community organizations that continues to grow.<sup>384</sup> The Ceasefire Campaign is even being heard in Washington!<sup>385</sup>

Unlike, the New River Valley Chapter of the Sierra Club, the Virginia and National Sierra Club is a member of the Ceasefire Campaign as well as the Environmental Patriots of the New River Valley. The visibility of the Minden success is inspiring deeper community mobilization across open burning sites by fostering solidarity, pooling of strategy, and sharing of expertise among groups of concerned citizens about socioenvironmental risks from open burning. The evidence of this is in the many direct actions taken by the Environmental Patriots during spring of 2016, and robust collaboration between Volunteers for the Environment, a Tennessee fenceline citizen group at the Holston Army Ammunition Plant, who are advocating for cessation of open burning at BAE's Tennessee plant.

The development of fenceline knowledge and expertise offers potential resistance strategies to intervene in the process of risk construction. I argue that the fenceline standpoint is critical to the pursuit of environmental justice. Sharing knowledge and expertise of fenceline struggles across polluting sites expands knowledge and expertise, helping those engaged in environmental justice research at the nexus of expert risk approaches, policy decisions, legal-regulatory frameworks, and divergent fenceline experiences. Minden is an exemplary case in how the action of local citizens on the fenceline in Louisiana have inspired others across the United States.

Camp Minden is directly connected to the Radford case. Radford Arsenal is the only producer of nitrocellulose in the United States. M6 is 85% nitrocellulose, 10% dinitrotoluene, 3% dibutylphthalate, and 1% diphenylamine. Minden's improperly stored M6 propellant was produced at Radford. The EPA's memorandum on the Camp Minden Case, entitled "Request for

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382 Smith and Marx, 102.

383 Citizens for Safe Water Around Badger, "Cease Fire Campaign | CSWAB," Citizens for Safe Water Around Badger, <http://cswab.org/resources/cease-fire-campaign/>.

384 Ibid.

385 United States Environmental Protection Agency, "Coalition Pushes to End EPA Policy Allowing Open Burning of Munitions," in Superfund Report (Inside Washignton Publishers, 2016).

Approval of an Amended Time-Critical Removal for M6 and CBI Propellant at the Explo Systems, Inc. Site, Minden, Webster Parish Louisiana” includes the Propellant Product Identification sheet for M6 which lists Hercules plant in Radford as the site of production.<sup>386</sup> EPA officials confirmed that the Propellant Product Identification sheet lists the facility where the material was produced. Explo Inc., the Army contractor implicated in improperly storing the material at Camp Minden, received material from Radford.

The material safety data sheet for M6 identifies that the product is manufactured at RAAP. This product information bulletin details Hazard Information, First Aid Information, Fire Fighting Measures, Accidental Release Measures, Handling and Storage, Exposure Control/Personal Protection, Physical/Chemical Properties, Stability and Reactivity Data, Disposal Considerations information for the product.<sup>387</sup>

Events at Minden occurred because of production at Radford Arsenal. Radford produced M6. The exact nature of how much of the M6 came from Radford cannot be established because of unanswered FOIA requests and lack of response from officials as they cannot identify if any other facilities produce(d) M6. However, EPA officials did indicate that Explo received from Radford. Repeated requests for the Army Ammunition Plant Data Cards for the material at Minden were not fulfilled.

According to a Lexington Institute article entitled “Radford Army Ammunition Plant: The Heart of the U.S. Ammunition Supply Chain,” and a United Press International Article “You can’t fight a war without nitrocellulose” the only source of nitrocellulose in North America is the Radford site.<sup>388</sup> Daniel Goure, states:

The Radford plant is a unique facility. It alone among the 14 existing plants of the U.S. ammunition-producing industrial base has an acid-concentrator facility that produces the nitric and sulphuric acids that, when combined with cellulose in a one-of-a-kind facility at Radford, make nitrocellulose, the essential ingredient for all propellants and explosives used throughout the U.S. Army's ammunition industrial base. Therefore, Radford is a primary producer of gun propellants and the only producer of nitrocellulose.<sup>389</sup>

All probabilities point to the fact that most of the explosive constituents found at the Minden site, including the 16 million pounds of M6 Propellant and the 661,000 pounds of nitrocellulose, began their journey to Minden’s contained burn structure from the Radford facility.<sup>390</sup>

The connections between the two sites; from the production of the raw materials in Radford, to the explosion of the material in Minden, have resulted in unintended consequences of synergy between the two sites working to stop open burning. Collaborations to implement a cease fire of open burning of hazardous explosives material at Minden are being pursued at Radford.

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386 Ronnie Crossland, "Memorandum: Request for Approval of an Amended Time-Critical Removal for M6 and CBI Propellant at the Explo Systems, Inc Site, Minden, Webster Parish Louisiana ", ed. US EPA (Online: Region 6, 2015), 003416.

387 Ibid., 25-28.

388 Lexington Institute, "Radford Army Ammunition Plant: The Heart of the U.S. Ammunition Supply Chain - Lexington Institute," @LexNextDC, <http://lexingtoninstitute.org/radford-army-ammunition-plant-the-heart-of-the-u-s-ammunition-supply-chain/>.

389 Goure.

390 The researcher was unable to verify the Army's Ammunition Data Cards for the M6 sent to Camp Minden. This would be useful for future researchers to request.

Minden has created a national fenceline movement against open burning. Sharing of organizing tactics, fenceline expertise, and information has increased social solidarity among groups of people adversely impacted by industrial pollution and is contributing to greater expertise on the fenceline about the dangers and risks of open burning.

### ***Brief History of the Louisiana Army Ammunition Plant:***

To situate the emergence of contained burn technology at Minden, a brief institutional history of the site is necessary in order to contextualize the circumstances of the deployment of contained burning as an alternative technology to open burning. Differences need to be explained to contrast this case to Radford Arsenal, where historically little, but growing community involvement to stop open burning has occurred in recent years. Minden's success to implement contained burn technology has provided community members a model to strive for across the United States. Despite Minden's successes many open burning grounds continue to incompletely combust and disperse hazardous waste across fenceline communities.

The Louisiana Army Ammunition Plant was constructed in 1942 east of Shreveport, Louisiana. Today the plant is called Camp Minden. Currently the site is a National Guard training facility operated by the Louisiana National Guard. The ammunition plant is located off Interstate Highway 20 east of Shreveport Louisiana in the northern part of the state known as the Ark-La-Tex region. It is approximately 27 miles south of the Arkansas border as the crow flies. Camp Minden used to be known as the Louisiana Ordnance Plant. It is similar to the Radford site.

Much of the background history is easily accessible to the public from a Historical Properties Report. LAAP was one of 60 plants constructed of the type built at the onset of World War II.<sup>391</sup> The facility was part of the Army's Armament, Munitions, and Chemical Command (AMCCOM) when the Historic Properties Report was created.<sup>392</sup> The report was prepared in 1984 for the United States Army Material Development and Readiness Command (DARCOM) for assisting the Army in bringing LAAP into compliance with the National Historic Preservation Act of 1966.<sup>393</sup>

The Ammunition Plant's development is comparable to Radford Arsenal. The plant sits on a 14,974 acre site. It is much larger than Radford in terms of total area. Unlike RAAP, the facility is categorized as a SUPERFUND-CERCLA government-owned-contractor-operated (GOCO) facility. It is listed as non-operational on the National Priorities List even though the Louisiana National Guard now uses the facility.<sup>394</sup>The facility initially comprised 674 buildings, 364 of which

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391 Stuart E MacDonald and David A Fey, "Historic Properties Report. Louisiana Army Ammunition Plant, Shreveport, Louisiana,," (BUILDING TECHNOLOGY INC SILVER SPRING MD, 1984), 5.

392 Ibid. AMCCOM was formed in 1983 as the result of the merger of the U.S. Army Armament Materiel Readiness Command and the U.S. Army Armament Research and Development Command (ARRADCOM). The merger reunited the management of R&D and the life cycle sustainment under one command. See: "Army Sustainment Command History Newsletter," ed. Army Sustainment Command (Army Sustainment Command April 15, 2012). In 1994 ACCOM became the Industrial Operations Command in 1994. The IOC became the US Army Operations Support Command on October 1st 2000. In early 2003 the OSC was renamed the U.S. Army Joint Munitions Command. The command remained at Rock Island Arsenal and included the U.S. Army Field Support Command as a Major Subordinate Command of the Army Material Command. See: The United States Army and Joint Munitions Command, "The Joint Munitions Command - a Concise History," <http://www.jmc.army.mil/Historian/JMCHistory.aspx>.

393 MacDonald and Fey. The report was conducted through an agreement between the National Park Service, the Department of the Interior, and the U.S. Department of the Army.

394 Ibid.

date from World War II. In 1968 an accident destroyed one production area. Production ceased in 1994. The ebbs and flows of foreign conflicts affected production. Operations continued to take place intermittently from 1942 until 1994 depending on demand.<sup>395</sup> The facility produced conventional ammunition.<sup>396</sup>

Operation of LAAP began in 1942 with eight ammunition lines and one ammonium nitrate graining plant. The plant's operating contractor was the Silas Mason, Co.<sup>397</sup> LAAP produced 65 different ammunition items during World War Two. Similar to RAAP, in the summer of 1945 the plant was placed on standby status after VJ Day.<sup>398</sup> LAAP was reactivated in February 1951 during the Korean conflict. The Remington Rand Corporation operated the plant until February 1958. All ammunition loading lines were operated under the responsibility of Remington Rand, Inc. Remington Rand designed a forging and machining plant for manufacturing 155mm projectile metal parts. The plant was placed on standby status in 1958.

In response to military conflict the plant was reactivated in 1962 to support United States' involvement in the Vietnam War. During Vietnam the operating contractor was Sperry Rand. Four production areas were reactivated for classified ammunition items.<sup>399</sup> The facility produced "mines, shaped charges, fuses, boosters, bombs, demolition blocks, projectiles, etc."<sup>400</sup> The peak employment of this period was in 1969. After Vietnam, the Thiokol Corporation assumed operation of the plant in 1975. All production ceased in October of 1994.<sup>401</sup>

Thiokol is the same company that is implicated in the O-ring saga of the Challenger launch decision.<sup>402</sup> Thiokol changed their name multiple times after the Challenger disaster and eventually transformed into ATK. ATK is the company that operated Radford Arsenal after Hercules in 1995 before BAE Systems took over in 2012. The history of Thiokol in the munitions industry deserves more scholarship. For example, ATK's New River Energetics at RAAP currently possesses a depleted uranium handling permit.<sup>403</sup> Thiokol's production capacity has inspired considerable interest in the field of STS, but much more work needs to be done to recount the key contributions of such a powerful organization in American war making.

Publically available documents do little to examine the period of time during Thiokol's tenure of operation of the plant from 1975 to 1994. The lack of information during this period is similar to the missing disclosure in the case of Radford's history.<sup>404</sup> According to the 2001

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395 Nationwide Environmental Title Research LLC, "Louisiana Army Ammunition Plant Superfund National Priorities List (NPL) Site," <http://environment.netronline.com/site.php?cid=LA0213820533>.

396 MacDonald and Fey, 4.

397 Doyle Williams, "Installation Action Plan for Louisiana Army Ammunition Plant," ed. Army Materiel Command (United States Army, 2001).

398 "Louisiana Army Ammunition Plant," Global Security, <http://www.globalsecurity.org/military/facility/aap-louisiana.htm>.

399 Williams, 2.

400 "Louisiana Army Ammunition Plant".

401 Williams, 2.

402 Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at Nasa* (Chicago: University of Chicago Press, 1996).

403 "Alcoa: News: News Releases: ATK to Acquire Thiokol Propulsion from Alcoa," Alcoa, [http://www.alcoa.com/global/en/news/news\\_detail.asp?pageID=16881-2001\\_03\\_19&newsYear=2001](http://www.alcoa.com/global/en/news/news_detail.asp?pageID=16881-2001_03_19&newsYear=2001).

404 Lack of examination of products prepared or wars prepared for during this time illustrate the rise of the United States as the largest weapons dealer in the world in almost perpetual war from the end of Vietnam to the present. The fact that no deactivation occurred after Vietnam, unlike previous times, illustrates how ingrained militarism has

Installation Action Plan for LAAP, the Mission Statement of the plant is trifold: 1) Layaway and maintenance of projectile metal parts manufacturing facility. 2) Facility use contract allows commercial applications of facilities. 3) The plant is administratively combined with Longhorn AAP.<sup>405</sup> The Installation Action Plan stipulates the current status of the plant for the specified year and is updated each year. Similarly, Radford also has facility Installation Action Plans released annually. These reports are valuable documents for assessing the years' operating goals at these facilities and the history of operations.

Open burning was not new at the Minden site. Historically, open burning of waste was conducted at the Louisiana Army Ammunition Plant. Open Burning Ground (BG-5) was used for burning of waste explosives and contaminated waste from 1947 to 1996.<sup>406</sup> In 1955, this area had six burn cages and several burn or detonations areas. In 1996, the burn or detonation area consisted of three raised earthen berms that sloped toward a concrete catch basin. According to the 2001 Installation Action Plan for LAAP, "Precipitation flowed from the burn pads to the shallow dikes between the pads to the concrete catch basin. The basin was closed in 1983. Since 1986, explosive waste at BG-5 has been detonated underground."<sup>407</sup> An additional burning ground, Burning Ground Eight, became part of a landfill and two lagoons. The 60 acre landfill was used as a burning ground for explosives from the 1950s through the 1970s. Burning Ground Three was also used, but became part of a landfill for pink explosives wastewater. This area is now known as Area P.<sup>408</sup> Open burning at LAAP was normal. Like other sites, LAAP utilized open burning. Open burning is a national hazardous waste dispersion technique that occurs throughout the country and is not unique to LAAP, RAAP, or HAAP.

Unlike RAAP, LAAP is a SUPERFUND site. Clean up and remediation at the installation began in the late 1970s when the Interim Response Action Remedial Investigation for Area P Lagoons were conducted.<sup>409</sup> LAAP cleanup is prioritized under CERCLA or SUPERFUND. The Installation Action Plan from 2001 stipulates: "The army is investigating waste disposal areas, manufacturing areas, burning grounds, and testing areas for any detrimental environmental impact by implementing its environmental response authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) / Superfund Amendments and Reauthorization Act (SARA)."<sup>410</sup> While not the focus of this chapter, a complete investigation of the status of cleanup and its effectiveness on the fenceline is prime ground for further juxtaposing the Radford Site and Camp Minden in terms of cleanup and remediation under SUPERFUND and RCRA. A comparison of the two cleanups is fertile terrain for scholarship and environmental justice researchers interested in the toxic legacy of munitions manufacturing.

A cleanup underway illustrates the laboratorization of the area and fenceline. There is documented toxicity at the site. I situate LAAP's CERCLA designation to point to differences between RAAP. A major difference is the RCRA categorization of Radford Arsenal vs the

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become in USA society. This empirical point illustrates the rise of a powerful military-industrial complex in the United States through perpetual conflicts that see no periods of disarmament.

405 Williams, 2.

406 Ibid., 22.

407 Ibid.

408 Ibid., 24&25. I provide context to show that open burning occurred at this site well before the proposal to burn the improperly stored M6 propellant.

409 Ibid., 3.

410 Ibid., 2.

CERCLA status of LAAP in examining the decision to use open burning as a waste disposal treatment technique.<sup>411</sup> SUPERFUND necessitates greater public participation creating standards of public participation in contrast to RAAP. The SUPERFUND designation helped to achieve greater public involvement after the explosion in 2012 as the facility was already open to disclosure and public participation that a CERCLA designation affords. Furthermore, the facility was shut-down so there is no national-security secrecy concerns which accompany active production as found on the Radford or Holston fenceline.

### *A Disaster on the Fenceline, An Explosion Rocks the Paradigm of Open Burning:*

Minden is the first success by a fenceline community to resist new open burning proposals. This case represents a key breakdown of the open burning paradigm for the disposal of explosives waste in 21<sup>st</sup> century United States.<sup>412</sup> The 2014 proposal to implement new open burning at the site followed a contractor's criminal actions. Explo's negligence created conditions for an explosion of improperly stored of M6 Propellant. In retaliation fenceline community members mobilized to successfully resist the imposition of new open burning risks to their community. Minden's successful fenceline opposition signals a significant challenge to the legitimacy of open burning as an acceptable method of hazardous waste explosives disposal. This case illustrates how robust fenceline community organizing, knowledge, expertise, and partnerships with engineers and regulators can reduce risk and enhance fenceline participation.

The Minden disposal controversy is fundamentally complex, filled with rich examples of how the public can co-construct a sociotechnical fix. To adequately examine the events at Camp Minden from 2012-2016 requires an oral history project or an ethnographic account to fully understand and document the immediate events and how they have impacted other open burning fencelines across the nation. Minden's example is central to challenging the open burning/open detonation (OB/OD) paradigm of explosives waste disposal in the United States. Minden created momentum to make open burning of waste munitions obsolete.<sup>413</sup> I do not pretend to do justice to the entirety of all the actors, the people, the places, and those who sacrificed their lives to stop open burning on their fenceline.

Instead, I explore the origin of the crises, controversy, decision to open burn, retraction of the open burning contract, and final settlement on contained burn technology using publically available documents from the administrative record of the Camp Minden Dialogue. I argue that Minden is vitally important due to its role in shaping fenceline knowledge and expertise surrounding the practice of open burning/open detonation of explosives constituents. Minden shows the powerful role that fenceline residents can play when they activate local knowledge and empower themselves through fenceline knowledge and expertise.

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411 Further research should be conducted on the categorization of federal facilities as RCRA vs CERCLA to determine how such a determination effects overall public participation, risk mitigation, and rehabilitation of contamination at these sites.

412 Another node are the cases being documented in the open burning around US troops in the fields of battle. Veterans are challenging the safety of open burning in theaters of war. The practice in the field is substantially more toxic because all waste from wars is often open burned. See: J. Hickman and J. Ventura, *The Burn Pits: The Poisoning of America's Soldiers* (Hot Books, 2016).

413 I do not pretend to give adequate treatment to the history of the Minden controversy. Instead I tell enough to frame my arguments about knowledge, society, technology, science to illustrate the importance of Minden within the discourse on the safety of open burning available to the public.

It is important to recognize that the fenceline standpoint can influence technical and scientific experts. The American Chemical Society (ACS) represents 157,000 professionals in the field of chemistry and chemical engineering. The CEO of this organization sent a letter to the Secretary of Defense, Ashton Carter, and EPA Administrator, Gina McCarthy, asking why the outdated practice of open burning is still being used. Dr. Thomas Connelly Jr. writes, “ACS advances the chemistry enterprise, seeks to increase public awareness and appreciation of chemistry and its practitioners, and applies its expertise to public policy matters. Some ACS members have requested that we contact you about the continued open burning of munitions and toxic chemicals in the U.S. and ask why, in 2016, is open burning still being used?”<sup>414</sup> Connelly, representing an organization of chemistry experts and professionals, specifically mentions the success of grassroots efforts to challenge open burning in Minden. He writes, “Our members observe that it was only after citizens’ grassroots efforts that the open burning plan was abandoned and a contained burn system using an advanced pollution abatement system was installed at Camp Minden to destroy the munitions and igniters.”<sup>415</sup> Connelly and the American Chemical Society directly acknowledge the fenceline contribution of grassroots activists who challenged open burning as safe and acceptable. This demonstrates how the actions of fenceline experts translated into questions from professional scientific and engineering experts about the continued use of open burning.

Minden frames the conclusion of this dissertation by providing the background to the emergence of the national Ceasefire Campaign to end OD/OB of munitions. This case illustrates the opening of cracks in the paradigm of acceptable risk of open burning/open detonation for regulatory experts and military experts. The Environmental Patriots of the New River Valley have opposed open burning since 2008 at Radford, but Minden represents the first time fenceline activists were able to successfully force EPA regulatory experts to pursue and implement alternatives.

The reversal of the decision to open burn and the full weight of the ACS questioning the continued reliance on the practice signals the breakdown of the paradigm of open burning and open detonation as acceptable hazardous waste treatment practices. Minden is a fundamental crisis in the normal puzzle solving of the OD/OB hazardous waste treatment program.<sup>416</sup> This case represents the beginning of the implementation of a contained burn paradigm across the United States through the simultaneous breakdown of traditional expert discourses of the safety of risk from open burning/open detonation for the fenceline communities of munitions sites.

### ***Explo Systems INC Explodes: Improper Storage of Propellant Evacuates Town:***

To situate the breakdown of the open burning/open detonation paradigm I recount the explosion which shook the fenceline precipitating the explosives crisis. On October 15, 2012 an explosion of a bunker containing M6 propellant occurred at around 11:30 PM local time inside the fence of the Louisiana Army Ammunition Plant. The explosion jolted the attention of the community rocking the fenceline. In the months following the explosion the Louisiana State Police investigated Explo Systems Inc., an army contractor who they found responsible for the explosion. Explo was a recycling company who specialized in the repurposing of military explosives for

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414 Connelly Jr and Society.

415 Ibid.

416 Thomas S Kuhn, *The Structure of Scientific Revolutions*, 3rd ed ed. (Chicago, IL: University of Chicago Press, 1996).

secondary use. They sent many repurposed products to the West Virginia coal fields to blast away the mountains. The Louisiana State Police eventually issued warrants for criminal charges against those responsible for the disaster.

The severity and disruption of the explosion is captured by a *Huffington Post* interview with Frank Peetz of Doyline. Doyline is the fenceline community most impacted by the explosion at Camp Minden. Mr. Peetz states, ‘We got outside the evacuation area when they said there was a million pounds. Now it’s six million... Maybe we ought to be up in Arkansas somewhere.’<sup>417</sup> Col Mike Edmonson commander of the Louisiana State Police stated, “‘Nobody can tell you what 6 million pounds of explosives would do if it went up... And I don’t want to find out.’” The explosion was serious. According to interview on KSLA News 12, Mike Ewing describes the situation: “‘the store started shaking, everything... the vents and stuff fell out of the ceiling.’” Billy Edwards said “‘the sky lite up to the west... it lit up again... looked like a sunset it was so bright.’”<sup>418</sup> The explosion was felt as far west as Texas.

The National Weather Service later released a statement that described the radar imagery showing a debris/smoke plume right around 11:30 p.m., one and one half miles southwest of Dixie Inn where the Louisiana Army Ammunition Plant is located.<sup>419</sup> Please see the list of figures for a picture of the radar capturing the explosion. According to the article:

An initial event occurred at Latitude/Longitude Latitude/Longitude 32.578 N, -93.351 W which is in the borders of the Camp Minden Army ammunition plant. A large flash was observed, citizens were shaken out of bed and windows were shattered during the late night hours. The Shreveport, La National Weather Service Doppler Radar captured some images of the plume caused by the explosion. The first image captured by the radar occurred at 11:28 pm cdt, with subsequent images captured at 11:37, 11:47, 11:56 and ending at 12:06 am cdt. Based on radar analysis, the plume was initially as high as almost 7200 feet above ground level. The sampled radar imagery is very similar to what is usually seen with smoke plumes associated with wildfires, it was more vertical and concentrated as it traversed the area from southeast to northwest at approximately 10 mph. It slowly dissipated after approximately 34 minutes.<sup>420</sup>

The visible smoke plume reached 7000 feet into the atmosphere. The cloud is described in multiple online sources as a “mushroom cloud.”<sup>421</sup> Webster Parish Sheriff Gary Sexton explained that hazmat experts told him that the underground storage bunker containing explosives that blew up worked exactly as it was supposed to. According to KSLA, a local television station, “Sexton describes the bunker, in the ‘L-1 area,’ as an ‘igloo,’ constructed of concrete. He says they were

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417 HolBrook Mohr and Kevin McGill, "Louisiana Town Evacuated after Explosive Material Found," *Huffington Post*, [http://www.huffingtonpost.com/2012/12/03/louisiana-town-evacuated-explosive-materials\\_n\\_2229479.html](http://www.huffingtonpost.com/2012/12/03/louisiana-town-evacuated-explosive-materials_n_2229479.html).

418 KSLA Staff, "Webster S.O. Confirms Bunker Explosion at Camp Minden," (KSLA, 2012). See also security footage available on YouTube at: [https://youtu.be/\\_hqov-UnGpM?list=FLRaMHcQnQLyMnrKQ44q2sAA](https://youtu.be/_hqov-UnGpM?list=FLRaMHcQnQLyMnrKQ44q2sAA)

419 Ibid.

420 NOAA US Department of Commerce, National Weather Service and National Weather Service, "Webster Parish Explosion Caused by Explosion of Old Munitions at Camp Minden Last Night," NOAA's National Weather Service, <http://www.srh.noaa.gov/shv/?n=webster-parish>.

421 Mark Schleifstein, "At Camp Minden, State Asks EPA Chief to Assure Safe Disposal of Toxic Artillery Propellant," *Nola News*, [http://www.nola.com/environment/index.ssf/2015/01/state\\_asks\\_epa\\_administrator\\_t.html](http://www.nola.com/environment/index.ssf/2015/01/state_asks_epa_administrator_t.html). Tim Murphy, "The Town from "True Blood" Is Filled with Toxic Explosives the EPA Fears Will Blow Up," *Mother Jones*, <http://www.motherjones.com/environment/2015/03/david-vitter-camp-minden-true-blood>.



built in the 50s. The underground bunkers are designed to send any blast up instead of out to lessen the shock wave impact. No one was injured.”<sup>422</sup> While no one was immediately injured by the explosion, the release of explosive combustion products are toxic and the explosion caused structural problems for buildings in the area.<sup>423</sup>

Doyline was evacuated by the Louisiana State Police upon the discovery of even more improperly stored propellants that were kept outside, exposed to the elements, in buildings not rated for explosive storage. These buildings would not have directed an explosion upward instead of laterally. The use of non-explosives rated buildings to house material significantly jeopardized the fenceline community as a shockwave in the event of another explosion would have moved laterally across the fenceline threatening structures in a 360 degree radius. As more information was uncovered, the magnitude of the crisis grew, posing a huge risk to the fenceline of another, possibly worse explosion.

Throughout the 10 day period between November 28 and December 7, 2012, the fenceline community remained evacuated during “operational hours.”<sup>424</sup> Over 400 homes were evacuated disrupting everyday life. Fenceline residents were forced to confront the reality of their location next to the facility in an immediate, visible, and tangible way.<sup>425</sup> Fenceline trust was violated by the disaster. Residents and explosives experts were worried that another repeat disaster would occur. Expectations of another disaster grew as events unfolded and knowledge of the magnitude of the improperly stored explosives came to be understood. The consensus of trust that previously sustained fenceline relationships between the Minden site and the community frayed at the seams, disrupting the status quo.

According to the EPA’s Minden Chronology on September 30, 2013, “The Bankruptcy Court approved an Explo Systems and Louisiana Department of Military transfer and settlement agreement transferring title of all materials and inventory to the Louisiana Department of Military.” The state become responsible for the failures of a for-profit company who was allowed bankruptcy protections. Bankruptcy excused the company of all liability for the disaster. As of mid-2016 no executive has received a criminal conviction, but trials are pending.<sup>426</sup>

Explo operated in a neoliberal environment, where corporate responsibility is outsourced to taxpayers and fenceline residents.<sup>427</sup> This neoliberal business environment allows companies, permitted by the state, to profit from the handling of military-grade toxic material, to file for

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422 KSLA Staff.

423 Please see: Bonnie Culverhouse, "Wall of Downtown Building Begins to Collapse," Minden Press-Herald, <http://press-herald.com/wall-of-downtown-building-begins-to-collapse/>. A historic building’s back wall buckled in on itself. Culverhouse explains, “Culpepper said the cracks in the back of the structure housing Café on Main and Timeless Antiques and Collectibles at 615 Main Street, were “huge and the windows were tilted and the building was obviously bent into itself. . . . Charlie Odom believes the building could be the most recent victim of the explosion at Camp Minden that rocked Minden and a large area of the Ark-La-Tex more than two years ago.”

424 United States Environmental Protection Agency, "Camp Minden Chronology," (2015).

425 Philip Caulfield, "True Blood' Town in Louisiana Evacuated after 6 Million Pounds of Explosive Powder Discovered Stashed in Old Military Factory," New York Daily News, <http://www.nydailynews.com/news/national/law-town-evacuated-explosives-article-1.1212208>. Mohr and McGill. Murphy.

426 On August 31, 2016a US Attorney announced a grand federal grand jury brought a 32 account indictment charging 6 form Explo, Inc. employees of federal crimes. See: KSLA Staff, "6 Explo Officials Indicted Related to 2012 Explosion at Camp Minden," KSLA 12 News, <http://www.ksla.com/story/32942090/6-explo-officials-indicted-related-to-2012-explosion-at-camp-minden>.

427 David Harvey, *A Brief History of Neoliberalism* (Oxford: Oxford University Press, 2005).

bankruptcy with impunity. Bankruptcy protections encourage a corporate welfare model of limited liability laws which create legal protections for negligent companies putting fenceline residents at risk by outsourcing risk to the state and fenceline community.

Explo's failure to properly maintain the propellant caused the explosion that rocked Doyline and other communities in the area. This negligence resulted from the marketization and outsourcing of critical national security tasks to the perturbations of the private market. Outsourcing of crucial state functions, a key component of neoliberalization, is documented by Philip Mirowski and David Harvey.<sup>428</sup> Harvey characterizes the history of neoliberalization over the past 40 years as a socio-political-economic ideology. Instead of the Army ensuring that the propellant was properly stored a key government function of munitions supply chain management was outsourced to a for-profit company. Explo's irresponsibility was enabled via a systemic socioeconomic environment that allows private companies to conduct crucial state functions of military munitions management and logistics.

The neoliberalization of the management of munitions logistics created conditions for lack of oversight by DOD and the US Army. Allowing the privatization of the function of military logistics to a private firm assumed trust in the market to maintain the safety of the munitions supply chain from cradle to grave. Explo's explosion and bankruptcy illustrates fundamental contradictions of the neoliberalization of essential state functions like military logistics management.<sup>429</sup>

Bankruptcy is used by negligent companies to insulate themselves from responsibility and liability to the fenceline. Similar to the 2014 Elk River West Virginia mining chemical spill, Explo used bankruptcy to avoid liability for negligence. Fenceline residents suffer in this neoliberal era of corporate negligence and state collusion. Explo's bankruptcy allows immunity for a company's negligence while forcing the fenceline public and the taxpayers to foot the bill, come to the rescue, and assume control of the damaged risky situation. Similar to accounts of coal companies leaving behind environmental disasters through limited liability protections, Minden showcases how contractor negligence precipitated a disaster which required state intervention at the expense of the fenceline public. The fenceline assumes the full risk and costs of the negative externalities created by the dissolution of a for-profit company through bankruptcy.

Explo's long standing pattern and history of safety violations is documented by the Federal Government. In 2007 the company was cited for violations for use of old army explosives in mining operations in West Virginia where a blast with "outdated deteriorated military ordnance" injured one worker and exposed others to toxins.<sup>430</sup> Mother Jones' reporter Tim Murphy documents the long historical incompetence of Explo to carry out its work in safe manner around fenceline community members. Murphey explains:

There was reason for scrutiny. In 2006, a series of 10 explosions at the Explo plant there caused the evacuation of the entire town of Doyline—including two schools and 441 inmates from the Webster Parish jail—and shut down Interstate 20 for six hours.

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428 Ibid.

429 Neoliberalization of state functions like military logistics management is a ripe area for further STS scholarship. See the works of Philip Mirowski, specifically Philip Mirowski, *Science-Mart: Privatizing American Science* (Harvard University Press, 2011).

430 "Explo Systems Investigation," <http://www.ktbs.com/story/22392275/explo-systems-investigation>.

And 10 days before that, a series of explosions at a nearby military flare manufacturer, also based at Camp Minden, shut down production at the site for more than a month. Explo's out-of-state operations also had issues. One worker was injured and others exposed to toxic materials at a West Virginia surface coal mine in 2007 where Explo Systems had supplied outdated military explosives for mountaintop removal. (The company was slapped with six federal mine safety violations, totaling \$12,000.) But Explo continued to receive Army contracts.<sup>431</sup>

The company struggled to pay rent at a Louisiana National Guard base while working on an Army contract to demilitarize hundreds of thousands of propelling charges used for artillery. Despite Explo's incompetence it was awarded more contracts.

Ultimately, ineptitude, lack of oversight, and improper storage from a negligent contractor resulted in an explosion on Monday, October 15, 2012.<sup>432</sup> According to EPA, this explosion prompted the attention of the EPA and the Louisiana State Police. The Louisiana State Police served a warrant to Explo Systems after an investigation identifying 10 million pounds of unsecured M6 Propellant. Explo's long run of negligence ended at Camp Minden. Eventually the number would grow to over 16 million pounds of improperly stored explosives.

According to Congressman John Fleming of Louisiana, lack of oversight by the Army precipitated a huge munitions explosion blasting the community of Doyline in 2012.<sup>433</sup> Six individuals were charged and arrested in June 2013. The president of the company and at least two other executives of the Louisiana explosives recycling company were among those indicted.<sup>434</sup> Additionally, each indicted worker faced five felony charges: unlawful storage of explosives, reckless use of explosives, failure to obtain a magazine license, failure to properly mark explosive material, and failure to keep accurate inventory.<sup>435</sup> A seventh worker was later indicted. The

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431 See: Murphy. Explo's role in mountain top mining should be more fully explored. While we discussed coal slurry the provision of mining explosives ought to be investigated to more fully explore the links between weapons manufacturing, disposal, and mining.

432 United States Environmental Protection Agency, "Camp Minden Chronology."

433 House Committee on Oversight and Government Reform and Committee on Natural Resources, *EPA's Animas Spill* 114th United States Congress, September 17 2015.

434 Jeff Amy, "6 Arrested in La. For Improper Explosives Storage," The Associated Press, <http://theadvocate.com/home/6295393-125/6-arrested-in-la-for>.

435 Eventually 7 workers total indicted. 3 would plead guilty and testify the others avoiding any jail time. The proceedings are still moving forward as of the writing of this. See: Holbrook Mohr, "3rd Guilty Plea Expected in Explosives Case," Associated Press, <http://www.fox5vegas.com/story/23603025/3rd-guilty-plea-expected-in-explosives-case>. Nancy Cook, "Seventh Explo Systems Manager Arrested," ArkLaTex.com, <http://www.arklatexhomepage.com/news/top-stories/seventh-explo-systems-manager-arrested>. Michael Kile, Lionel Koon, and Todd Dietrich all took deals to testify against their former coworkers David Smith and David Fincher, as well as plant manager Terry Wright. See: "7th Explo Employee Indicted on Ten Charges," KTBS ABC 3, <http://www.ktbs.com/story/26489953/7th-explo-employee-indicted-on-ten-charges>. Clifford Morrison eventually surrendered. According to the Shreveport Times reports there were arguments made in court that M6 was an accelerant not an explosive. This classification regime deserves more investigation from STS scholars as to how materials are classified and the legal apparatuses mobilized to regulate these materials. See the Shreveport Times Article "UPDATED: 7th former Explo employee surrenders on indictment."

"Worsey testified the M6 is an accelerant rather than an explosive, said Marvin, who intends to call his own explosives experts at a later date to prove otherwise. He said the defendants are attempting to try their case through their motion to quash."

reckless actions of Explo Systems' improper storage of millions of pounds of explosives criminally jeopardized the safety of the fenceline.

Following the explosion at Camp Minden there were many requests for information related to the remaining propellant by many government organizations including: Department of Defense, Environmental Protection Agency's Region 6 RCRA Branch, Louisiana State Police, Louisiana Military Department Adjutant General, Army Explosives Safety Board, Louisiana National Guard, The Army, General Dynamics, and Alliant Techsystems.<sup>436</sup> Interest surrounded the developments at the site due to the severity of the explosion and the necessity to mitigate risk of another explosion. The degrading material would further jeopardize fenceline residents each day that the unstable and improperly stored munitions remained on site.

The Louisiana Military Department requested the transportation of the improperly stored propellants. In March of 2013, The Department of Defense declined request for the possible transport and storage of the M6 propellant, citing lack of authority and funds to seize the excess private property.<sup>437</sup> In April 2013, the Army Explosives Safety Board (ESB) was asked by the Louisiana Military Department to conduct a technical safety assessment. The goal of the Army Explosives Safety Board technical safety assessment was to determine how the material might be safely disposed.

In May of 2013 the ESB conducted an assessment of all explosives hazards associated with Explo Systems' facilities at Camp Minden. They investigated the storage magazines to evaluate the potential risk of another explosion. The safety board investigated the munitions and abandoned explosives stored in the open. The board stated "that the preponderance of evidence indicates that the probability of an explosives event directly related to the long-term storage of M6 propellant at Camp Minden is likely. Controlled open burning and open detonation was recommended by the ESB."<sup>438</sup> On June 20 the Explosives Safety Board recommended a narrow time window to destroy the material by open burn/open detonation "within 2 years," citing "...concerns about the long term stability and safety of the explosive materials in the magazine..."<sup>439</sup>

Transportation of explosives is risky. Expert agencies constructed transportation as riskier in lieu of leaving the material on site. The risk of transportation would jeopardize more people should an accident occur while the material was on the road. Transportation of millions pounds of explosives is a national security concern. Trucks could be ambushed, hijacked, or subject to theft. Explo's failures generated new risks for the fenceline as the government stepped in to remedy their negligence in order to avoid another explosion. The disaster precipitated effects that were felt beyond the fenceline. Open burning/open detonation was constructed as the preferred method of remediation by agency experts.

#### ***Department of Defense's Decision to Open Burn as Technical fix to Contractor Negligence:***

Instead of transportation, government agencies went with the standard method of explosives destruction: open burning/open detonation. Use of open burning was constructed as the easiest and least risky method to destroy the material. Open burning would mitigate fenceline risk in the cheapest and easiest solution to avoid another explosion. OB/OD is standard technological

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436 United States Environmental Protection Agency, "Camp Minden Chronology."

437 Ibid.

438 Ibid.

439 Ibid.

practice for explosives destruction. The practice of OB/OD has a long history of use and is considered an acceptable method by the Army Explosive Board. Regulatory agencies conceptualized open burning as the safest way to minimize risks of another disaster at the site.

EPA sent an Administrative Order on Consent (AOC) to the parties it had identified as potentially responsible parties (PRPS). Information was requested from: US Army, Louisiana National Guard for the Louisiana Military Department, Explo, General Dynamics, Alliant Techsystems (ATK). The Army declined to negotiate and cited its opinion that it had limited to non-existent liability with the Camp Minden site. EPA Region 6 notified Explo Systems, Louisiana National Guard (LNG), the US Army, Alliant Techsystems, Inc., and General Dynamics that it considered them to be PRPs at the site. EPA offered to negotiate administrative orders to conduct removal work needed at the site. The information established that ATK was the generator of tritonal and nitrocellulose, hence establishing ATK's liability.<sup>440</sup>

At first public involvement was not solicited and the matter was handled internally by the various agencies that the EPA identified as PRPs. While the agencies were acting to minimize the risk to the fenceline, the decision to choose OB/OD ignored the effects that this method would have on the fenceline. Plumes, ash, products of incomplete combustion, and partially combusted toxic material would be emitted and disproportionately create health risk along the fenceline. OB/OD would externalize the costs of the PRPs onto the fenceline members of the public.

There are a number of significant actors, events, texts, and decisions whose accounts are important in the initial decision to open burn. However, this decision is routine and executed by daily by the DOD and their contractors. The decision to implement open burning at Camp Minden deserves scholarly treatment. However, this chapter focuses on the resistance to OD/OB by citizens to create a sociotechnical fix by innovating and challenging establish methods of hazardous waste explosives disposal in the United States.

On October 28, 2014 "the United States Army (Army), the Louisiana Military Department (LMD), the Louisiana Department of Environmental Quality (LDEQ) and EPA Region 6 signed an Administrative Order on Consent (AOC) that includes payment for, and the conduct of removal response actions needed to dispose of 15-16 million pounds of M6 propellant and 320,000 pounds of Clean Burning Igniter (CBI)."<sup>441</sup> This decision formalized the Explosive Safety Board recommendation to implement open burning at Camp Minden.

On December, 3, 2014 a test open burn was conducted by EPA, Louisiana State Police, LMD, and LDEQ.<sup>442</sup> Local media and officials were notified after the burn was conducted. On December 5<sup>th</sup>, 2014 the Minden newspaper gave notice of a community meeting summarizing the decision to open burn the material.<sup>443</sup> Almost immediately a fenceline controversy was created. The fenceline came to understand that open burning was the preferred technique of disposal of the M6 material through the press. The decision to open burn spurred community action when little public participation existed prior to the test burn.

Events following the test burn testify to the resilience and power of fenceline community members to implement change. Fenceline community members came together to resist the largest

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440 Ibid.

441 Crossland, 1.

442 United States Environmental Protection Agency, "Camp Minden Chronology."

443 Ibid.

proposed chemical burn in the history of the United States.<sup>444</sup> The test burn poured fuel onto the fire of a previously germinated distrust of the management of the situation around Camp Minden created by the disastours saga of Explo's negligence. Local community members lived with the threat of explosions from the improper storage of the waste propellant. Now the decision to implement OB/OD threatened the fenceline community with a toxic assault by jeopardizing health, air, water, and soil quality because of the reckless and criminally indicted Explo Systems Inc.

***Citizen Engagement for Epistemological and Environmental Justice:***

This unique combination of events, ignited by an explosion disaster, culminated in the threat to fenceline residents from the risk of OB/OD. These conditions created an amicable environment for the implementation of alternatives to open burning and open detonation. Eventually through the galvanization of fenceline activism and expertise a solution would be found that included the concerns and participation of the fenceline community.

The proposal to open burn, in conjunction with fenceline resistance to this proposal, culminated in the creation of the Camp Minden Dialogue. The dialogue provided the forum for the implementation of a solution that brought together stakeholders to ensure the minimization of risk for the fenceline. The dialogue produced the arrival, construction, testing, and application of a sociotechnical fix: a contained burn structure designed and built by El Dorado Engineering in early 2016. The proposal of open burning/open detonation paved the way for citizen involvement, organizing, and regulatory experts to hear all stakeholder concerns through a dialogue process which sought to minimize risk and avert future disasters at the site in order to safely dispose of the improperly stored propellant at Minden

I do not pretend to speak for all the important actors nor the action of those concerned citizens who were able to press for alternative technology at Camp Minden. I focus on the official chronology of the EPA, publically available news reports and articles to trace important citizen engagement identified within the Camp Minden Dialogue chronology. This is not a comprehensive oral history or ethnographic treatment of the many actors who were active in pressing for alternatives. I provide a point of reference for future scholarship on this critical case of the implementation of alternative technology in lieu of open burning.

At the beginning of 2015, after the trial burn was conducted and the citizens were made aware of the decision to open burn, fenceline residents quickly mobilized to oppose the implementation of open burning of millions of pounds of explosives in their community. Discursively, the publication "Proposed M6 Burn a Health Risk" in the Shreveport Times by Professor of Chemistry at Louisiana State University-Shreveport, Dr. Brian Salvatore, is a key event. Salvatore used his expertise in chemistry to communicate to the fenceline the risks from open burning. The newspaper article summarizes the dangers and health risks from open burning of nitrocellulose and M6. The inclusion of this article in the administrative record understates the importance of the article in propelling the creation of the Camp Minden Dialogue.

The Camp Minden Dialogue Chronology lists December 27, 2014, as the date that Dr. Brian Salvatore's article detailing health concerns of open burning/open detonation was published.

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444 See the recorded testimony of Dr. Brian Salvatore , General Russel Honore, and Col Samuel Mims before the Louisiana Louisiana House Natural Ressources and Environment Committee, "Hearing before the Natural Resources and Environment Committee," (Louisiana House Website: Louisiana House of Representatives, April 27, 2016).

The chronology states, "December 27, 2014, Article written by Dr. Salvatore regarding the hazards of OB/OD."<sup>445</sup> The *Shreveport Times* lists December 22, 2014 as the date published for Dr. Salvatore's article. Salvatore, a chemist on the governing body of the American Chemical Society, lays out the case for why open burning of hazardous waste is dangerous to public health and safety. He states, "North Louisiana faces an enormous public health risk from the proposed open-tray burn of chemical explosives at Camp Minden...This represents one of worst-ever cases of criminal negligence in the storage of explosives at a military contract site in U.S. history. It was due to a combination of gross incompetence by the contractor and very poor site supervision by the U.S. Army that we now face this very serious predicament with limited alternatives."<sup>446</sup> Salvatore's expertise in chemistry conveys the seriousness of the proposal to open burn. He explains:

The three other main components of M6 are all derivatives of aromatic hydrocarbons, each with significant toxicity, ranging from respiratory irritation, carcinogenicity and endocrine disruption. Of greatest concern among these substances are dinitrotoluene and dibutylphthalate. Dinitrotoluene exists primarily in two different isomeric forms. Both forms are harmful, but the more harmful form is known as 2,6-DNT. This substance has demonstrated highly toxic effects in studies conducted on both dogs and mice, including anorexic weight loss; neuromuscular incoordination, and rigid paralysis of the hind legs. 2,6-DNT is also a known carcinogen, which has been shown to cause liver and kidney cancer in mice, and it is estimated that about 20 percent of the DNT in M6 is of the 2,6-isomeric form. It also has moderate water solubility and can even be taken up by plants and wildlife, where some is stored in their tissues. DNT is toxic if it is breathed, orally ingested, or absorbed through the skin.<sup>447</sup>

Like at Radford, open burning of DNT was about to occur. According to Salvatore, open tray burning of these aromatic compounds is likely to cause them to vaporize due to their thermal stability and modest boiling points.<sup>448</sup> M6 also contains dibutylphthalate which was used in some nail polishes. Dibutylphthalate was banned in 2006. This is a powerful endocrine disruptor causing reproductive damage in adults as well as abnormalities in human fetuses and disrupted development of male genitalia.<sup>449</sup> Partial combustion also creates byproducts due to inefficiencies of the combustion process of open burning. Temperature, oxygen content, and turbulence of the material in an open burn cannot be sufficiently controlled to ensure complete combustion of the material.

Dr. Salvatore translated the specific threats of open burning into a language accessible to the general public. The releases of these chemicals through vaporization and incomplete combustion by way of inefficient and uncontrolled open burning constitutes a health threat according to the expertise of Salvatore. The public translation of science through the publication of his article in the *Shreveport Times* is a critical point in the debate over open burning of hazardous waste at Camp Minden. This article outlines the dangers of open burning to the lay person using scientific expertise. The mobilization of scientific expertise, challenging open burning, created distrust within the fenceline. Salvatore's argument undermines the idea that open burning is an acceptable means of waste disposal. Open burning was championed by the regulatory agencies

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445 United States Environmental Protection Agency, "Camp Minden Chronology," 9.

446 Salvatore.

447 Ibid.

448 Ibid.

449 Ibid.

tasked with minimizing risk and protecting the public from the degraded material at Minden. While regulatory agencies claimed OB/OD as safe, Salvatore, an expert in chemistry, illustrated why it was not.

Salvatore's scientific background and expertise helped to foster mistrust through the use of a scientific argument about the threat of open burning on the fenceline. Creating mistrust of open burning experts and proponents was instrumental in finding alternative solutions with reduced environmental and human health risk.

Questioning open burning helped to create inquiry into the proposed open burn solution offered by the agencies tasked with remediating Explo's disaster. This text, while contextualized to the Minden Controversy, makes arguments which are unbounded to the local specificity of the Minden site. Open burning of DNT is a national issue. This text calls into question the safety of open burning throughout the country. Salvatore's expertise has been brought to cases like Clean Harbors in Louisiana, Radford, China Lake, and Holston as evident in the American Chemical Society letter.

Along with Dr. Salvatore's scientific based article condemning the practice of open burning, a statewide progressive group also presented a letter to officials questioning the decision to open burn. According to the administrative record on January 27, 2015 Louisiana Progress Action's Director of Organizing Frances Kelly submitted "An Open Letter Regarding the Proposed Open Burn at Camp Minden." On January 28, 2015 EPA responded. Kelly first appealed to EPA rules which stipulate public participation in the implementation of decisions. She stated, "...the people who will be most affected by your decisions have not been a part of the remedy selection process, nor were we invited to participate in this meeting..."<sup>450</sup> She referred to the October, 2014 meeting in which the agreement was signed authorizing the open burn of Explo's improperly stored explosives. Kelly made the case that fenceline knowledge, expertise, and participation was discounted by those who proposed open burning.

Frances Kelly laid out an argument based in regulations of open burning. She stated, "The planned open burn is not allowed under the Resource Conservation and Recovery Act and there are no waivers of the applicable or relevant and appropriate requirements discussed in either the Administrative Settlement Agreement and Order on Consent for Removal Action or the Request for Approval of a Time-Critical Removal at Explo Systems, Inc. Site, Minden, Webster Parish, Louisiana."<sup>451</sup> RCRA prohibits open burning of hazardous waste, and only allows open burning and detonation explosive wastes when alternatives are not present.

For example, 40 CFR 265.382 of the United States stipulates that, "Open burning of hazardous waste is prohibited except for the open burning and detonation of waste explosives. Waste explosives include waste which has the potential to detonate and bulk military propellants which cannot safely be disposed of through other modes of treatment."<sup>452</sup> Kelly argued that M6 can be safely disposed by other modes of treatment. She explains, "...the EPA's Material Safety Data Sheet clearly states that M6 'MAY ALSO BE BURNED IN AN INCINERATOR APPROVED FOR EXPLOSIVES.' When a safer mode of treatment exists for a military

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450 Frances Kelly, January 27, 2015 2015.

451 Ibid.

452 Cornell University Law School, "40 CFR 265.382 - Open Burning; Waste Explosives," Legal Information Institute, <https://www.law.cornell.edu/cfr/text/40/265.382>.



propellant, the propellant cannot be legally disposed of through an open burn [sic].<sup>453</sup> Kelly mentioned that over the past 15 years the Department of Defense Explosives Safety Board (DDESB) has certified a number of technologies as safe for the destruction of hazardous wastes that are explosive. Her appeal to the regulation stipulates that EPA's approval of the open burn of M6 decision violates the law because alternative technologies have been adopted and are in use by the DOD and the private sector. Kelly argued, "Since alternatives clearly exist to the open burning of munitions, the exclusion originally adopted by EPA is no longer valid."<sup>454</sup>

While Kelly's arguments are specific to Minden they have become crucial to fenceline residents opposing open burning grounds in their communities organized through the Ceasefire Campaign, Radford, and Holston. The use of Kelly's arguments by other communities illustrates how the diffusion of fenceline knowledge and expertise is enabled by new digital social media technologies. Nationwide, fencelines of open burning grounds carefully monitored developments at the Minden site. Ceasefire is in contact with community organizers across the nation.

Kelly strengthens the argument against open burning by appealing to fenceline risk. She specifically uses a discourse appealing to how the people who will be put at most risk were not included in the decision making process. Her argument underscored the need for active fenceline community input and participation. Her discursive position examines the risk posed to the fenceline community by appealing to its important standpoint.

The most carcinogenic substances currently known to mankind, dioxins and furans, can be formed through open burning due to the inability to control the residence time of the waste in the combustion zone, the turbulence of the material, and the cooling rate.<sup>455</sup> She explained, "In an open burn, it is impossible to deploy conditions to minimize the formation of dioxins and furans."<sup>456</sup> She juxtaposed the primitive technology of open burning to more advanced treatment technologies which are designed to increase the efficiency of the waste treatment process to reduce the conditions that form dioxins, furans, and PCBs when aromatic organic compounds are open burned.<sup>457</sup>

Salvatore's expertise questioned the safety of open burning in contrast to the ESB's logic justifying open burning. Similarly, the Louisiana Progress Action's letter pointed out internal EPA expert disagreement about the decision to open burn. Kelly explained, "...it is clear that there was even sharp disagreement within the EPA, itself, about the decision to select the open burn as the only remedy that would be considered to dispose of the M6 propellant."<sup>458</sup> The disagreement signals a lack of consensus among experts. Kelly explained that the lack of consensus should necessitate further open discussion and evaluation of the decision to open burn. She described "...all subject matter experts, including those who disagree with the decision to do the open burn, must be allowed to weigh in on the science..."<sup>459</sup> Only through transparency of the process can the safest decision be made. Kelly normatively pointed out that in order for the safest decision to be

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453 Kelly.

454 Ibid.

455 Ibid.

456 Ibid.

457 Ibid.

458 Ibid.

459 In his philosophy of science, Karl Popper made fundamental claims about openness and access to knowledge in context to political decisions. Openness is fundamental to the conduct of a free society. See: Karl R. Popper, *The Open Society and Its Enemies*, 4th ed. rev. ed. (Princeton, N.J: Princeton University Press, 1963).

made the public has a right to know what all of the experts at the EPA think about the proposed open burn at Camp Minden. Furthermore, "...a full and transparent discussion and evaluation of the science" is the only way to make a safe decision. Kelly appealed to open discussion of science and public participation as the best normative means through which a safe decision can be made. Technical decisions embed assumptions about risk for fenceline community members, and their participation is necessary to avoid unduly jeopardizing the safety of the fenceline. Kelly's articulation of the need for greater participation and debate about the practice of open burning is an attempt to achieve a stronger objectivity about the practice by enrolling more people into the evaluation and decision making processes.

Kelly relied on a legal analysis of the RCRA rules pertaining to open burning of explosives. Discursively, she challenged the implementation of the open burn technology devoid of the solicitation of public and fenceline participation to advocate for alternative technology. She elevated the norms of openness, transparency, and dialogue as critical for the proper adjudication of fenceline risk. Fenceline knowledge and expertise needed to be included in decisions regarding the implementation of open burning. She explains how all opinions must be considered regarding the sociotechnical decision to implement open burning:

The EPA's community relations in this project have been a disaster, and this has undermined the public's trust in the EPA and in the process. Moving forward, the EPA, the Army, and the State of Louisiana must commit to include the public in every part of the process, including in the selection of a safer remedy to dispose of the M6 propellant. No decisions can be made behind closed doors. All subject matter experts at the EPA, including those who disagree with the open burn, must be allowed to publicly weigh in on the credibility of the science.<sup>460</sup>

Frances Kelly's open letter was sent to many officials involved in the selection of open burning as a "safe" disposal method. Together with Dr. Brian Salvatore's article, widely disseminated with the public, their texts mobilized the fenceline. Salvatore's article enunciates scientific concern grounded in his years of expertise and work within chemistry and cancer research. Scientific expertise, widely disseminated, in conjunction with calls for fenceline community organizing and participation helped to propel a social movement which advocated for alternative solutions.

Both Kelly and Salvatore argued for a reconsideration of open burning outside of the institutional framework of regulatory agencies and the company slated to benefit from open burning. Their texts created distrust within the fenceline community about the proposed open burn. Ultimately through the civic engagement of concerned citizens the Camp Minden Dialogue was created by the EPA to offer the institutional space needed to include fenceline concerns about the risk from open burning. The dialogue sought to find acceptable solutions for the destruction of the explosive material with the least risk for the fenceline.

### ***Camp Minden Dialogue: Co-constructing a Sociotechnical Fix:***

While these two discursive texts condemning open burning are incredibly important, they achieved greater meaning through fenceline activism and organization against open burning. The beginning of the New Year in 2015 signaled a period of great change. A citizens' group was organized to stop open burning. The Concerned Citizens of the Camp Minden M6 Open Burn

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460 Kelly.

achieved a social media presence in January, 2015. This group's organizing efforts sought to activate the public participation calls that Kelly championed heeding the concerns made public by Dr. Salvatore. Together they sought to find alternatives to open burning.

Kelly's letter articulated one of the first public fenceline citizen documents of the Minden controversy. Fenceline knowledge and expertise organized to counter open burning as a safe means of propellant disposal. Kelly and Salvatore's narratives illustrate the discursive beginnings of a social movement to find alternative to open burning of hazardous waste explosives. The organization Concerned Citizens of The Camp Minden M6 Open Burn would propel a number of protests and events that were critical to building social movement behind the discursive positions of Kelly and Salvatore.<sup>461</sup>

According to an article by Josh Fast, posted on the Concerned Citizens of Camp Minden's website, the earliest indication of a rally Camp Minden residents held their third rally on Saturday, January 17, 2015 to #StopTheBurn. Fast explains:

The Concerned Citizens of the Camp Minden M6 Open Burn, the group spearheading fierce opposition to the open burn, had a rally Saturday at The Farm. They mixed a strategy planning session — the third since the group formed two weeks ago — with a relaxed atmosphere allowing them to get to know each other. The majority only connected through Facebook but have formed a solid bond in their united fight.<sup>462</sup>

Digital media technologies, such as the social network Facebook, were instrumental in connecting fenceline citizens who engaged for environmental justice at the intersection of science, technology, and society. Many rallies were held, including the production of a music video to #StopTheBurn, exemplifying diversity across race, class, gender, and class barriers to efficiently argue for and implement an alternative, safer, and more efficient technology than open burning.<sup>463</sup> The organization of concerned citizens helped to produce a reevaluation of the use of open burning by the US EPA to remedy Explo's disaster, throughout the Minden Dialogue.<sup>464</sup>

A consciousness among supporters understood that open burning is an experiment of tolerable limits of toxic releases on the population. For example, reporter Troy Washington explains "Emotions are running high and the grass roots group working to stop the open burn now has more than 8,000 members and counting. 'We're going to be the guinea pigs and I don't want to be pushed off into a test tube' said [Agaytha] Bryant."<sup>465</sup> Concerned Citizens like Ms. Bryant, explained that "they don't know what this is going to do to human beings."<sup>466</sup> She explained she doesn't trust the trial open burn either.<sup>466</sup> Citizens make specific normative arguments against the implementation of open burning into their community through an appeal to the uncertain risk

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461 While not the subject of this dissertation, there is considerable oral history, and ethnography to be conducted with participants of the movement to resist open burning in Minden. Complementing Salvatore and Kelly's arguments was the work of the Green Army, founded by Retired General Russel Honore. General Honore's participation signals the involvement of insider military personnel within the dialogue.

462 Josh Fast, "Camp Minden Residents Hold Rally to #Stoptheburn | Stop the Burn LA," <http://stoptheburn.richard-creative.com/media/camp-minden-tenants-to-practice-safety-plan/>.

463 Concerned Citizens of Camp Minden M6 Open Burn, #Stoptheburn (Youtube2015).

464 United States Environmental Protection Agency Region 6, "Camp Minden Dialogue," US EPA, <https://www.epa.gov/la/camp-minden-dialogue>.

465 Troy Washington, "Concerned Citizens Working to Remove Open Burn Option from EPA's Radar," KSLA, <http://www.ksla.com/story/27936719/concerned-citizens-working-to-remove-open-burn-option-from-epas-radar>.

466 Ibid.

categorizations of the computerized modeling of open burning risk first deconstructed by Salvatore's article.<sup>467</sup> Furthermore, as evident by Bryant's characterizations, there is evidence that a consciousness of open burning of hazardous waste explosives around people is an inherently experimental activity.<sup>468</sup> Fenceline residents opposed the further laboratorization of their environment via new risks from the imposition of open burning.

Environmental justice organizing in opposition to open burning, combined with advocating fenceline citizens, who mobilized the accounts of Frances Kelly and Brian Salvatore, and collaborated with policy makers like Louisiana State House of Representative member Gene Reynolds, propelled alternatives to open burning into existence at Camp Minden. Washington explains, "On Thursday, Professor Brian Salvatore and Representative Gene Reynolds participated in a press call that outlined the believed health dangers of the chemicals in the M6 propellant and other explosives at Camp Minden. Dr. Salvatore mentioned everything from cancer, to birth defects and autism."<sup>469</sup> The combination of a social movement of open burn opposition, local citizen-scientific-policy opposition, and the loud anti-burn social movement fostered conditions favorable to holding a dialogue between stakeholders to construct a sociotechnical fix. Fenceline concerned citizens would become experts in opposition to open burning. Kelly's demands for public accountability and transparency was granted after numerous public demonstrations and vocal fenceline resistance from the concerned citizens.

Citizens refused to bear the risk from the criminal actions of Exploratory. For example, at the same time the concerned citizens were organizing on January 13, 2015, "... 7 individuals have been indicted and 3 have plead guilty."<sup>470</sup> On January 15, the EPA received a letter from the Louisiana Military Department, and the Louisiana Department of Environmental Quality asking for alternatives to open burning to be considered. Two letters from the Louisiana Department of Environmental Quality were sent directly to EPA National Administrator Gina McCarthy, asking for her intervention to force EPA Region 6 to demonstrate that open burning is the best remedy.<sup>471</sup>

The EPA held a dialogue among interested stakeholders to select an alternative to open burning the M6 propellant. A combination of contributions from public activism, scientific, technical, and legal doubt about the safety of open burning created sociotechnical pressure to find safer and less risky methods to remediate Exploratory's crimes. Minden is a Superfund site with a Citizens Advisory Group, chaired by Ron Hager.<sup>472</sup> The dialogue committee enrolled the citizen advisory group into its discussions. Minden benefits from Superfund's Technical Assistance Services to Communities (TASC) contract that provides communities with independent technical expertise. These conditions converged to create the Camp Minden Dialogue. From January 2015 until May 8, 2015 the dialogue committee met to discuss alternative technologies and include the public in the decision about how to remediate the M6 situation. In early May it was announced a

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467 See Radford Chapter. Risk determinations were discussed regarding ecological and human health risks from open burning.

468 See the discussion of the experimental nature of open burning in context to Ulrich Beck and Risk in the previous chapter on open burning and risk at Radford Army Ammunition Plant.

469 Washington.

470 United States Environmental Protection Agency, "Camp Minden Chronology."

471 Ibid.

472 Empirical fenceline analysis of how RCRA sites are organized vs. Superfund sites is an important domain of fenceline environmental justice research.

contained burn system would be used to conduct the cleanup.<sup>473</sup> On Wednesday June 17, 2015 the dialogue succeeded in securing a contract with Explosive Service International (ESI) to destroy the improperly stored propellant through contained burning.<sup>474</sup>

Contained burning allows for full control of the efficiency of the combustion process. Better control mitigates risk by adequately controlling the temperature, oxygen content, and turbulence of the material to ensure full combustion of the material. A contained burn chamber with a pollution abatement control system can ensure that the material is fully combusted by monitoring of the process of combustion. Comprehensive performance testing fully monitors emissions from the contained burn chamber. This technology substantially reduces emissions by orders of magnitude than what can be achieved through the primitive technology of open burning.

ESI partnered with El Dorado Engineering, based in Salt Lake City, Utah to design and build a contained burn structure to dispose of the toxic material. According to Dr. Brian Salvatore, the contained structure, excluding other components, weighs 206 tons and is 110 ft. tall. In 2016 the structure is the largest contained burn structure in the world.<sup>475</sup> The device would take a number of weeks to arrive on site. The enormous structure precluded easy truck transportation. Its travel by barge was delayed due to high water from large amounts of rain in early 2016 in the Mississippi River Valley.<sup>476</sup> The device sat for weeks as water was too high on the Arkansas River to float it down to Natchitoches Parish Port in Louisiana from its fabrication site in Oklahoma. Upon arriving in Louisiana, the structure was transported on a special truck to Camp Minden at just about 4 MPH due to special road closures and moving and lifting of powerlines.

According to Minden South Webster Chamber of Commerce's Facebook album: M6 Removal - Camp Minden "transport officials say the entire load weighed more than 300 tons, 181 feet long, nearly 26 feet wide and just more than 27 feet high. The trailer for the chamber had around 100 tires on it alone."<sup>477</sup> On February 11, 2016 the completed contained structure arrived in Camp Minden after beginning its journey in December of 2015.<sup>478</sup> Construction, already underway while the chamber was shipped, proceeded immediately upon the device's arrival at the Minden site. The first trial burn of 88 pounds was conducted on Wednesday April 13, 2016.<sup>479</sup>

In a little less than a year the fenceline succeeded in the successful lobbying, securing, and deploying of an alternative technology to open burning. As of May 4, 2016 over 500,000 pounds of M6 had been destroyed and Comprehensive Performance Testing would start in the next few weeks.<sup>480</sup> On May 24, 2016, Bob Hayes, President of El Dorado Engineering, indicated that the

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473 United States Environmental Protection Agency, "Camp Minden Chronology."

474 There are many events, discussions, letters, and documents not surveyed in which to examine the controversy between the EPA, LDEQ, Louisiana Military Department, about open burning of hazardous waste explosives. This is a fertile terrain of new scholarship to explore about the scientific safety of open burning, risk, and public participation.

475 Anne Cutler, "Wow! World's Largest 'Burn Chamber' to Destroy 15 Million Lbs of M6 Propellant," WGNOTV, <http://wgno.com/2016/02/12/wow-worlds-largest-burn-chamber-to-destroy-15-million-lbs-of-m6-propellant/>.

476 Michelle Bates, "Burn Chamber Arrives at Camp Minden after Long Journey," <http://press-herald.com/burn-chamber-arrives-at-camp-minden-after-long-journey/>.

477 Minden South Webster Chamber of Commerce, "M6 Removal - Camp Minden " THE MINUTE MAGAZINE [https://www.facebook.com/permalink.php?story\\_fbid=10154653745822818&id=75604987817](https://www.facebook.com/permalink.php?story_fbid=10154653745822818&id=75604987817).

478 Bates.

479 Lex Talamo, "Burn of Controversial M6 Underway at Camp Minden," Shreveport Times, <http://www.shreveporttimes.com/story/news/2016/04/14/burn-controversial-m6-underway-camp-minden/83047544/>.

480 This information comes from publically available information within the Concerned Citizens of the Camp Minden M6 Open Burn Facebook Group: <https://www.facebook.com/groups/campmindenopenburn/>

contained burn system at Camp Minden was performing better than initial specs. On June 13, 2016 Dr. Salvatore informed the concerned citizens that he spoke with Mr. Hayes again and the facility had exceed expectations during the Comprehensive Performance Testing. The contained burn unit obtained an efficiency of 99.9999% or six 9 efficiency rating. EPA only recognizes four 9s of efficiency. Officially EPA approved the use of the contained burn chamber on June 13, 2016. In a press release, EPA states:

The U.S. Environmental Protection Agency (EPA) has completed its review of the initial comprehensive performance test and formally approved the contained-burn system for use in disposing of 16 million pounds of M6 propellant and clean burning igniter held at the Louisiana Military Department's Camp Minden in Minden, La. The expedited report for the destruction of M6 showed the system destroyed 99.99% of the chemicals of concern.<sup>481</sup>

Ultimately, the device signals a much cleaner, more efficient, and better controlled method of breaking the M6 material down. This case shows that a problem caused by science and technology could be remediated through fenceline participation in the domains of science and technology. In early July 2016, 1.4 million lbs. of M6 has already been destroyed successfully.

The outcome of contained burn technology achieved consensus of an acceptable risk on the fenceline in juxtaposition to open burning as dangerous and risky. The contained burn chamber technology was constructed through the inclusion of the fenceline standpoint within the EPA Camp Minden Dialogue.<sup>482</sup> The dialogue represents a successful example of how fenceline knowledge and expertise can be incorporated to find solutions to complex sociotechnical problems. In the process of implementing contained burn technology fenceline activists became experts on open burning and alternative technology. The fenceline contributed to the development of alternatives by challenging the risk regime assuring open burning's safety through a grassroots movement that succeeded in persuading EPA to create a process that solicited the participation of policy makers, parties of primary responsibility, regulators, scientists and engineers, and fenceline community members. The inclusion of the fenceline standpoint into the process of the construction of risk significantly improves outcomes for managing high risk sociotechnical practices and the risks produced by these activities.

### ***Conclusion:***

I argue that direct, tangible, and invasive impact from the M6 explosion disaster helped to propel the dialogue that occurred at Camp Minden between stakeholders to find solutions to ameliorate the situation, reduce risk, and safely dispose of the toxic and hazardous explosive material. Residents were aware of the dangers of the situation of Camp Minden because of the explosion. There was a real fear of another explosion among residents and agency experts. People were worried about their property. Fenceline residents were unwilling to pay the risk costs from the fallout of the criminal negligence of Explo. This contrasts sharply with the lack of visibility throughout the recent history of operations at the Radford site where it has been many years since a major explosion occurred upwind of Blacksburg.

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481 United States Environmental Protection Agency Region 6, "EPA Approves Contained-Burn System for Camp Minden Disposal," US EPA, <https://www.epa.gov/newsreleases/epa-approves-contained-burn-system-camp-minden-disposal>.

482 "Camp Minden Dialogue".

The decision to open burn M6 concerns remediation in light of disaster. Unlike Radford, this case does not occur at an active production facility. Instead Explo's core business was recycling waste military munitions at an inactive army ammunition plant. The Minden Controversy grew out of a situation that links munitions and coal mining as explored in the first case on Black Mesa. Explo shipped explosives to the coal fields. Explosives and mining have always been fundamentally linked as this dissertation argues. The necessity of production as a dominant ethos did not guide the decisions of experts, and agencies. Instead this case is framed by a concerned citizen reaction to the failure of Explo Inc. to properly store explosives and reduce risk at the fenceline.

As in the previous cases, the open burning proposal meant that fenceline residents would be expected to shoulder risk from the engagement of a dangerous sociotechnical activity that would release toxic emissions of incompletely combusted material on the fenceline. The threat of another explosion justified the risk of open burning in the minds of the experts from the various government agencies tasked with remedying the situation. However, no one on the fenceline was initially consulted to determine if this was an acceptable risk: a recurring theme throughout this dissertation.

However, Minden was ultimately able to secure a public forum to contest the politics of knowledge and risk fenceline. EPA Regional Administrator Ron Curry explains. "By including community voices in the decision process, we found a solution that accounted for everyone's concerns."<sup>483</sup> Active citizen engagement, recognition of alternative technologies, and EPA Region 6's efforts to initiate dialogue out of a grassroots fenceline movement of concerned citizens was instrumental in fostering an environment for public participation and the critical activation of the fenceline standpoint. Scientific doubt expressed by Salvatore was mobilized through community protests about the risk of open burning on the fenceline. Grassroots organizing spurred innovation for cleaner waste disposal technology. Intensified negative publicity pressured officials to reduce risk for all stakeholders by hearing their concerns. Reducing risk in the face of growing public pressure precipitated the Camp Minden Dialogue and the construction of contained burn technology.

The design process to implement a sociotechnical fix was forged by community members' concerns about the toxic assault posed by open burning explosive material within their communities. Finding an alternative to open burning was a fix to a problem of environment, waste, and public relations among stakeholders in the context of doubt about scientific and technological expertise of the "safety" of open burning. Community members sought a reduction of toxic exposure by challenging the safety of open burning. Open burning sought to outsource the impacts of Explo's failure to the fenceline, residents would not shoulder those costs.

Robust community organizing of fenceline knowledge and expertise about the threats and toxicity from open burning for community members propelled the creation of the dialogue. The fenceline standpoint was given legitimacy throughout the dialogue. Community member narratives used scientific and technological knowledge to challenge the Department of Defense's narrative of the safety of the risk from open burning. Public involvement opened the pathway to the National Cease Fire Campaign, organized by Radford's sister plant's watch dog group, to end

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483 "EPA Approves Contained-Burn System for Camp Minden Disposal".

open burning across the United States. Minden's legacy has become an inspiration to communities across the United States working to stop open burning in their communities.<sup>484</sup>

Minden is the first example of a community successfully challenging open burning of hazardous waste in their community. The Minden case continues to inspire fenceline activists across the country to contest the narrative of safety by OB/OD proponents who adjudicate fenceline risk in context to open burning. The contained burn unit and other technologies explored during the Minden dialogue have become powerful symbols to diverse fenceline groups. Concerned citizens about the ongoing toxic assault of Virginia's largest open burning ground at RAAP have frequently referenced Camp Minden. The emergence of proven contained burn systems informed my scholar-activist approach in tackling open burning within my community.

I argue that mitigating risk from a future disaster due to the threat of more explosions from the degraded M6 required swiftness in the approach adopted by the stakeholders. There was the rapid need to develop a remedy to dispose of the improperly stored material to avoid future explosions that would jeopardize human health, property, and the environment on the fenceline. Mitigating future risks is evident in the Camp Minden Dialogue documents by the speed in which an alternative was implemented in just one year.<sup>485</sup>

The M6 disposal controversy at Camp Minden grew out of the improper conduct of a private firm handling US Army munitions constituents at a former US Army production facility. According to initial investigations, "the explosives recycling company that caused the evacuation of a Louisiana Town has come under scrutiny for explosions and its handling of dangerous materials before, and it was so far behind on its rent that the Louisiana National Guard refused to lease it more space."<sup>486</sup>

The immediate disaster drove a quick rehabilitation of the property to ensure no future risk. EPA Region 6 adopted a unique approach to minimize risk by holding a community dialogue seeking alternatives to open burning by enrolling fenceline participation. This case illustrates the potential of stakeholder collaboration on the fenceline to other communities. Unlike the previous chapters which focused on active production sites this case shows how a visible disaster propelled a controversy over mitigating future risk in and around the fenceline.<sup>487</sup>

The Minden Controversy illustrates how risk from open burning is redefined by citizens, scientists, and community organizers who intervened to oppose the practice after the initial decision to open burn by the Army Explosives Safety Board.<sup>488</sup> Unlike the narrative of safety in expert assurances to public by Radford Arsenal's producers and regulators, citizens in Minden successfully mobilized expertise and public-media-relations to challenge the narrative of open detonation/open burning safety. Collaboration and dialogue sponsored by the Environmental

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484 Citizens for Safe Water Around Badger. The Ceasefire Campaign was founded after the resolution of the Minden controversy which propelled open burning to the attention of the national press.

485 United States Environmental Protection Agency Region 6, "Camp Minden Dialogue"; United States Environmental Protection Agency, "Coalition Pushes to End EPA Policy Allowing Open Burning of Munitions."

486 "Explo Systems Investigation".

487 Mining on Black Mesa is a much more visible disaster compared to the silent and slow releases occurring at Radford, but having an explosion forcing the evacuation of Doyline is even more visible and invasive on the spectrum of daily life perturbations from industrial activities on the fenceline.

488 United States Environmental Protection Agency, "Camp Minden Chronology."



Protection Agency Region 6 provided the institutional support to implement an alternative and safer practice to dispose of the waste propellant.

Minden outlines the fundamental arguments of this dissertation by tying together the major themes examined in the previous chapters. Minden demonstrates how engagement of fenceline community members can implement and develop expertise, science, and technology to minimize risk. Full participation and inclusion of the interests of stakeholders was crucial to the implementation of contained burning. Specifically, community involvement, through a hearing of the standpoint of fenceline expertise and knowledge, can better build and bolster trust between regulators and the community to collaborate to find alternatives, minimize risks, and not discount the experience of those living in the most environmentally vulnerable spaces. Fenceline residents have a direct stake in the construction of risk in their community. Minden illustrates how residents can participate in the construction of risk in their community. An inclusive process avoided further environmental injustice.

Minden juxtaposes developments in science and technology about the hazardous nature of open burning and open detonation by fundamentally challenging the safety of the practice. Minden contrasts sharply with those regulatory and production experts who continue to legitimize the practice as safe at Radford, where the open burning permit is in the process of renewal.<sup>489</sup> Through fenceline engagement in Minden, open burning was deemed as unsafe and an alternative technology was deployed.

The developments in Minden highlight cracks in the paradigm legitimizing the safety of open burning. The publically visible dialogue about the risks of open burning munitions waste are now informing other sites of open burning.<sup>490</sup> Camp Minden helped to propel open burning toward the front of public consciousness through national press coverage. The controversy called attention to key issues in the United States' toxic legacy as the largest weapons exporter in the world through the very direct and noticeable community organizing that ripples across the country through the work of the Ceasefire Campaign.<sup>491</sup>

While the Minden case is essentially different than the Radford case; together they illustrate a growing spectrum of how the issue of open burning and open detonation of waste explosives is treated by different EPA regions.<sup>492</sup> Minden and Radford show the costs of conducting military munitions making through a legacy of toxicity, uncertainty, and risk for fenceline residents. Both cases navigate the politics of risk and knowledge at the intersection of environmental and toxic effects of conventional munitions disposal through open burning and open detonation.

This chapter shows the success of the Camp Minden Dialogue to alter the narrative of risk and safety around open burning by pushing for change in the disposal of explosives waste. I show

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489 Col Alicia Masson has pushed for the design and construction of a new energetic waste incinerator to push towards 100% treatment capacity of all waste instead of current 15% of energetic waste not being handled in the older incinerators. Though the plant is still seeking to renew the permit, the incinerator is in a design phase.

490 Kuhn.

491 Laura Olah is the founder of Citizens for Safe Water around Badger, which is a local group that works to address toxic munitions making legacy around Radford's sister plant, the Badger Army Ammunition Plant. Please see: <http://cswab.org/> and <http://cswab.org/resources/cease-fire-campaign/>

492 Comparing approaches to environmental issues within science and technology between EPA regions is a rich area for future scholarship as evident by the different approaches of EPA Region 6 regarding Camp Minden and EPA region 3 regarding Radford Arsenal's open burning.

how public participation is instrumental in the coalescence of a new paradigm of waste treatment that deconstructs open burning as a “safe” and “risk-free” technology. The discourse of technical experts changed to include normative commitments that would not have been recognized otherwise. The involvement of all stakeholders constructed open burning as not sufficient to the protection of human and environmental health at the Minden site. The implementation of contained burn technology occurred through the interaction and dialogue of divergent stakeholders. The process recognized that by including the fence-line standpoint a better outcome was achieved which substantially reduced risk. The Minden fence-line has fundamentally altered the politics of risk and knowledge of open burning, by showing to other communities the valuable achievements that fence-line residents can make when included and empowered.

## Chapter 5: Conclusion: Three Cases of Fenceline Knowledge

### *Overview: Three Cases in Conversation:*

The three cases explored in this dissertation illustrate the contested nature of the politics of risk and knowledge on the fenceline. Each case is divergent and unique. Yet, each points to the constructed and contested nature of risk that is produced fenceline sites. By focusing on micro-level cases I examine the macro-level by suggesting that the contributions of fenceline experience can strengthen our objectivity of the assessment of risk. Fenceline expertise and knowledge are important locations for the pursuit of environmental justice. In fenceline communities the politics of knowledge and risk can be mediated by fenceline expert-activists' interventions in the contentious politics of the construction of risk and knowledge.

I bridge the macro and micro by illustrating how successes on one fenceline can impact another by altering the construction of risk. Minden is a prime example. EPA's newsletter *Superfund Report* illustrates the profound impact Minden is having on the "problem" of open burning. In reference to the Ceasefire Campaign Coalition the report states:

The source says momentum for the coalition's push stems from grassroots efforts at Camp Minden, LA, where EPA backed off from its original plan to require open burning of unstable propellant and explosives after a large number of citizens in northern Louisiana raised concerns over impacts to the community from open burning and sought an alternative method.<sup>493</sup>

EPA recognizes a growing body of information "...indicating OB/OD is problem."<sup>494</sup> Problematizing open burning began on the fenceline by those who started to speak out, engage in activism and grassroots organizing by developing their own empowered knowledge and expertise. Similarly, in Black Mesa there is growing consensus emerging on the hazards of coal use in the Southwest. Grassroots organizing on the fenceline is pressuring discussions over the problems associated with water, power, and climate for the future of the region. At Radford, concerned citizens on the fenceline is continuing to press for air quality monitoring and the cessation of open burning.

Together all three cases show relationships between explosives disposal and the mining industry. Historically, these industries are fundamentally linked through the early and substantial use of Trinitrotoluene (TNT). Often degraded military explosives are reprocessed for the mining industry; a key function Explo's business model. At one time Radford Army Ammunition Plant was the only domestic supplier of TNT a product used throughout the mining industry.

I situate controversy over the risks of sociotechnical artifacts and practices by showing examples of the construction of risk from the beginning of a products' life to the end. Each case provides a different model in which to inquire into the politics of knowledge and risk on the fenceline.

The normative goal of each case seeks to empower fenceline community members. Researchers can gain insight and praxis into the successes and failures of a fenceline community

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493 United States Environmental Protection Agency, "Coalition Pushes to End EPA Policy Allowing Open Burning of Munitions."

494 Ibid.

to alter the politics of knowledge of risk by becoming scholar-activists. The inclusion of the standpoint of fenceline knowledge and expertise into the discursive analysis of risk offers a strategic location to strengthen our objectivity of the risk contestation of large-scale technological systems. I broaden knowledge of environmental struggle and risk within three contested spaces. Putting these three cases into conversation offers insight into how specific local situations challenged fenceline residents. In doing so I offer framework for scholar-activist environmental justice research in Science and Technology Studies that relies upon the standpoint of the fenceline.

I present three narratives of how large scale technoscientific systems impact different communities in different fencelines with significant variances. Depending on the location of the researcher, I recount three stories of risk in divergent places related together via the interconnectedness of the researcher to each space. Mobilizing indigenous critiques of research, crucial to environmental justice work on the Navajo Nation, helps to situate fenceline knowledge and expertise at the nexus of the contested nature of environmental justice. I argue that the subjugation of local knowledge is often experienced in colonial and fenceline spaces. Black Mesa specifically showed how the fenceline can be conceptualized as a colonial space in which fenceline knowledge is often discounted.

I discussed how production or destruction, via industrial processes, produces three different situations of risk which intersect the fenceline. I began with resource extraction, destruction of waste from production, and finished with the risk of a product requiring destruction when its use is no longer required. This research provides a model of how environmental justice scholar-activists can intervene within controversial risk arenas to broaden the communication of the dynamics of risk that fenceline communities face in relationship to the threats of industrial activities.

The politics of knowledge of risk on the fenceline is a contentious process. Fenceline risk is dynamic and changing, subject to an array of knowledge, technology, and scientific knowledge that informs the construction of risk. Sociotechnical processes shape our understanding of how fenceline risk is constructed between fenceline communities, regulators and producers. My aim in telling these stories is to increase solidarity, knowledge, and expertise between communities struggling with environmental justice issues, toxic emissions and contamination, and negative externalities of anthropogenic production.

I theorize these spaces as laboratories, each subject to contestations over the production of knowledge and risk. I strengthen our objectivity about divergent environmental struggles in the 21<sup>st</sup> century by recounting some of the major fault lines at the nexus of the politics of risk and knowledge in fenceline communities: secrecy, willful ignorance, regulatory categorization, technological access, scientific expertise, fenceline expertise, activist intervention, and the social issues of qualitative research in vulnerable fenceline spaces.

I illustrated how solidarity across fencelines sites helps to empower actors. The connections between Minden and Radford have yet to fully mature. Minden is central to the formation of cracks in the politics of risk of the paradigm which legitimizes open burning as safe. Communities on the fenceline can share stories, experience, expertise and knowledge to achieve collaborations in reducing risk from industrial activities when confronting powerful institutions in the 21<sup>st</sup> century. The Ceasefire Campaign is evidence of the vast potential for fenceline collaboration and exchange.

The visible results that Minden achieved are being seen and heard across the country. At Radford Arsenal activists continue to press forward. On July 4, 2016 Blacksburg's Coalition for Justice marched against open burning during the town's annual Independence Day Parade. Throughout the first weekend in August the Environmental Patriots participated in Blacksburg's annual street festival. They set up an informational booth to help educate the public on risks of open burning by lobbying for the use of alternative technology at Radford Arsenal. EPNRV collected 318 signatures to present to Virginia Department of Environmental Quality requesting that the agency convene a public meeting to discuss the ongoing renewal of the open burning ground permit. EPNRV conducted outreach and education on the events surrounding Minden to point to how contained burning is a reality.

This project shows how communication between environmental struggles builds knowledge sharing and solidarity across the fenceline for better access to activist-expertise and risk knowledge. The use of a first person narrative helps the account to remain reflexively committed to providing insight into successful strategies for scholar-activists working at the nexus of qualitative, sociological, and environmental justice research within Science and Technology Studies.

My normative aim is to help community members build broad coalitions to help each other, by telling a particular story about risk in divergent time and places to tease out common themes in the experience of risk within fenceline communities. This type of project requires knowledge of environmental struggles and the esoteric nature of regulatory and production expertise on the fenceline. Scholar-activists must become familiar with technical understandings of risk in order to push for better analyses, monitoring, and participation.

I contrast three divergent locations of the researcher by telling a story based my limited resources and proximity to each case within the time constraints of doctoral scholarship. Using examples to outline an emerging field of study entitled: Critical Risk Analysis; readers gain insight into particular strategies and models of qualitative research. I show the interdisciplinary nature of studying the politics of knowledge of risk within fenceline sites.

Each case is different with respect to my location as a scholar-activist researcher. The politics of knowledge and risk at the fenceline are similar despite varieties in the local context of each fenceline. People who live on fencelines experience different risks than those live and benefit far away from the fenceline. Fenceline residents confront complicated technical calculations of risk within their interactions with production and regulatory experts. Their lives are quantified by risk assessments.

I spent considerable time on the Navajo Nation, but I do not reside there, and only have visited a few times for an extended period of time. I am an outside legal researcher. In the case of Radford Arsenal I grew up next to the facility and played in a youth soccer league that held practice and tournaments at the complex. I identify as an inside fenceline community member. Finally, at Minden I came to know the controversy as part of my scholar-activism to stop the open burning of hazardous waste next to my home. I am an outsider telling a story of how the reception of Minden's success has influenced other fencelines. I have never been to the site of controversy though I have been party to many virtual discussions amongst the concerned community members who opposed open burning.

Minden shows how events in one fenceline can help to build solidarity, knowledge, and expertise across divergent fencelines. I was able to create a relationship with one of the main scholar-activists, Dr. Brian Salvatore. His work on the topic of open burning of hazardous waste in Louisiana has influenced other sites. As a fenceline resident of an open burning ground, any developments in the discourse of the safety of the practice of open burning concerned me. Dr. Brian Salvatore's engagement was instrumental to providing the scientific and technical expertise to fenceline residents impacted by the proposed open burning at Camp Minden. His work continues to provide guidance to other fenceline communities like Radford and Holston who struggle with renewal of their open burning ground permits.

I show how fenceline expertise and knowledge from one fenceline can influence the risk discourse of my own fenceline as a scholar-activist approach. Together community members mobilized discussions of Minden's contained burn system in community meetings about Radford Arsenal's open burning ground. We discussed the existence of the contained burn chamber in Minden, and the dialogue, to point to the primitive technology of open burning by questioning regulatory expertise and our exclusion from the process. Minden's success allowed community members at RAAP the opportunity to ask why the same technology is not deployed here during Army/BAE Systems community relations meetings.

As a model of STS research I recounted the story of the now defunct coal slurry line between the Black Mesa Mine and the demolished Mojave Generating Station in order to discuss the issues of risk that scholar-activists who work within indigenous spaces confront. Fossil fuel infrastructure in the Anthropocene is an important site of fenceline knowledge and expertise. I weaved together a first person account with the history of technology of the coal slurry line to illustrate the contradictions and challenges residents on the fenceline live with because of decisions made by WEST.

I did not use any sources from that cannot be found in the existing public record. I strategically did this to avoid any particular hang-ups with securing and navigating the complex and time consuming process of Intuitional Review Board permission needed to conduct ethnographic research in the colonial reservation system in the United States. This research lays the groundwork for further autoethnographic research on the fenceline. Land grabs, relocation, livestock impoundments, fracking development, Peabody relocation, and uranium contamination continue to threaten traditional Diné ways of being in the 21<sup>st</sup> century.

Part of the strategic decision to rely on publically available documents testifies to the current state of academic research for doctoral students in STS. Focusing on telling the history of sociotechnical artifact of a coal slurry pipeline helps focus inquiry onto the artifact while allowing for specific arguments to be made about the politics of fenceline risk. However, ethnography on the fenceline is fertile terrain for STS scholarship in environmental justice, but is outside of the time and funding constraints afforded to this doctoral researcher.

In the Radford Arsenal case I paint contestations over the risk from open burning hazardous waste at the open burning ground, rather than developing an ethnographic account of the people living in the area and their relationship with open burning. I combine an autobiographic reflexivity with a meta-analysis of risk to situate my lived experience on the fenceline in order to make arguments about the quantification of fenceline life and the politics of knowledge of risk from attending public meetings for over 2 years.

I do not focus on people as a qualitative researcher, but on the specific discursive practice of the construction of risk assessments which legitimize open burning as a method for disposing hazardous waste generated in the production of explosives, small arms ammunition, and fireworks at the Radford Arsenal. I contrast the two previous cases, in which I spent time as a researcher to the Camp Minden Controversy. I have not travelled to Minden physically, but have been present virtually, through social media technologies, to show how the struggles for environmental justice at one open burning fenceline can influence another.

This dissertation utilized a non-traditional approach by blending historical methods with reflexive sociological scholar-activist environmental justice methods and science and technology studies in a Dadaist collage to critically activate the idea of the fenceline. For example, the demolition of the Mojave Generating Station and the termination of slurrification illustrates how the fenceline impacts decisions about the vitality of sociotechnical systems which outsource risk into vulnerable spaces. Together, the three cases show how the development of fenceline knowledge and expertise, shared across different sites, offers potential resistance strategies to intervene in the process of the construction of risk. Generating more accounts of local issues and sharing them across concerned fencelines communities helps fenceline activist-experts intervene in the politics of risk and knowledge. Each case shows how scholar-activists can pursue environmental justice at the nexus of expert risk construction, policy decisions, legal/regulatory frameworks, and divergent fenceline experiences.

The Citizens for Safe Drinking Water around Badger (CSWAB) organized national opposition to the proposed munitions burn at Camp Minden. I keenly followed the evolution of this case and the national movement which grew out of its success. I came to understand much more about my fenceline location, next to an open burning ground, and the hazards of these operations because of the visibility of knowledge and expertise mobilized by the concerned citizens who questioned the safety of OB/OD waste treatment.

I argue that it is crucial for practitioners of scholar-activist environmental justice research to familiarize ourselves with expert narratives of safety, risk assessments, and permits so that we can understand the fundamental assumptions on which risk is constructed in fenceline communities. This labor helps environmental justice practitioners develop our own expertise which can mediate the intersection between plant expertise and the fenceline.

The analysis of Radford's open burning ground serves as a micro-level site to see benefits, struggles, and challenges of this type of research when applied to macro-level institutions like the military industrial complex. My focus on the military-industrial complex offers one model of inquiry and experience into the environmental impact, risk, and safety of the largest polluters in the world: the United States' Department of Defense. I do so by focusing on the complexity surrounding the operations at the hazardous waste management open burning ground of a large military production facility. Doing scholar-activist research on an active military facility is difficult and challenging as information is often not readily available, yet this is crucial arena for research because of the planetary effects of facilities like Radford Army Ammunition Plant.

Spring of 2016, during the writing of this dissertation, has proven a critical time for change at the Radford Arsenal. Under new leadership, Radford Arsenal Commander Alicia Masson has helped to remove bits of the shroud of secrecy encountered throughout this work. Lieutenant Colonel Masson presented in May 2016 that the facility has secured about 7 million dollars for an initial design of a facility to treat waste now sent to the open burning ground. The goal is to reduce

the waste currently being sent to the open burning ground by 100%, however, the continued renewal of the open burning ground permit indicates future battles are ahead for fenceline residents.

I was able to photograph and make public a variety of pictures of plumes from the open burning ground that were dispersing over the community. This visual evidence, in conjunction with the construction the unit at Camp Minden, is enabling members of the Environmental Patriots to challenge the continued operation of open burning in our community. While not completely successful with eliminating the practice, the promises for change seem to be in the air.

Through the efforts of helping to organize fenceline residents, I have documented how STS scholars and environmental sociologists can contribute valuable experience and knowledge to the study of risk and safety within the fenceline. This fenceline approach allows environmental justice scholars to bridge the gap between scientists, policy experts, regulators, and community organizers. My scholar-activist intervention on the fenceline of Radford's open burning ground has forced me to understand the science and technology of open burning and its alternatives. Finding and communicating information on open burning points to the need for a community fenceline liaison to help fenceline residents understand how risks are constructed by developing fenceline expertise.

As a community organizer, working with the dedicated efforts of Devawn Bledsoe, the founder of Environmental Patriots of the New River Valley, I have served in a capacity as an information organizers, collector, and communicator to engage and organize fenceline residents to better public understanding of risk. In doing so I have illustrated a praxis showing how science and technology studies is a crucial domain of research that can help to empower the fenceline. STS is uniquely situated to intervene in sociotechnical controversies. The field commits to interdisciplinary approaches that are increasingly required in complex and dynamic struggles over the politics of risk and knowledge on the fenceline.

Public participation in the process of risk evaluation and tolerable limits of emissions around large polluting industries is needed now more than ever as the challenges of the Anthropocene necessitate dynamic strategies for survival. Fenceline experiences are no longer contained to fenceline. Droughts, water pollution, air pollution, and climate change experienced on the Navajo Nation are increasingly generalizable across vast areas of the planet. The solution to pollution as dilution paradigm is undergoing substantial challenges as atmospheric chemistry catches up; making dilution no longer feasible.

This work offers a model of how STS scholar-activist researchers can intervene at the nexus of sociotechnical controversies and environmental justice on the fenceline. Part of this intervention is the creation of a meta-analysis of risk assessments in natural resource extraction zones or hazardous production facilities. Intervention broadens our knowledge and expertise of the contested nature of the politics of risk and knowledge. This dissertation offers an array of potential intervention strategies for developing fenceline expertise in the pursuit of environmental justice. Generating more accounts of local issues on the fenceline contributes to the creation of valuable knowledge and tools for researchers working across divergent risk regimes at many different fencelines.



### *Organizing Fenceline Expertise:*

Analyzing risk assessments contributes to awareness and helps to form a basis on which to address environmental justice in fenceline communities through an analysis of how a polluter justifies its releases. This analysis is an important component to environmental justice scholar-activist research in 21<sup>st</sup> century fenceline sites. Fenceline residents grapple with narratives of safety and risk, amidst considerable uncertainty, and mistrust of regulatory and production experts. These experts operate with an a priori claim to know safe limits of emissions due to their positions of power to privilege the necessary tools, knowledge, and expertise to adjudicate the boundaries of safety, tolerable exposure, and risk. These experts are by default insulated from question on the basis of their privilege to know.

Traditional experts are plant managers and engineers, army commanders, regulators, and other highly specific trained individuals who work on justifying continued operation and tolerable risk using networks of discursive expertise that intertextually and institutionally communicate safety to those on the fenceline. However, producer and regulatory experts only form one component expertise on the fenceline.

A second component of expertise comprises locals who live in the fenceline areas who have a knowledge of the local environment and experience pollution. The slurry case illustrated the profound changes traditional elders experienced during the laboratorization of their environment. These fenceline experts drew on their own expertise through observation and experiences with pollution and risk around the slurry fenceline. At Black Mesa these experts synthesize indigenous expertise and knowledge of the land through their interaction with the environment and the mining complex.<sup>495</sup> This type of expertise and knowledge exists at the intersection of the facility, environment, and fenceline community. Fenceline experts ground their experience in their understanding and recollections of events and observations of daily life throughout our experiences with a polluting facility.

Finally, a third category of expertise is those who work to organize local knowledge into institutions or affiliations of individuals around a fenceline. Scholar-activists engage in this type of expertise as well as fenceline environmental group like the Concerned Citizens of Minden, Environmental Patriots, or Citizens for Safe Water around Badger. My scholar-activism on Radford is an experiment into such an endeavor. I have organized a group called Hold Radford Arsenal Accountable. Our mission is to preserve and organize knowledge of the facility to better enable and create constructive change and reduce risk. These experts include myself and community members who organize data, stories, history, document emissions, and other information so as to communicate it with the fenceline public. The organization of this expertise broadens coalitions on fenceline environmental issues. Community members organize and engage in dialogue with members of the public or plant officials about the pollution of their fenceline facility. The Cease Fire Campaign, the Concerned Citizens of Camp Minden, and the Environmental Patriots are all institutionalizing the expertise of individual fenceline residents and the expertise that emerges through the comparison and solidarity generated by sharing accounts across fencelines.

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495 For perspectives on indigenous knowledge and expertise see the work of Verran. See also for broader discussion on developing alternative methodologies that recognize the contributions of knowledge from groups traditionally excluded outside of the hegemonic epistemic framework of modern science: Smith.

Scholar-activists at fenceline sites work to understand and learn the discourse which production and regulatory experts claim to safely manage risk. This requires understanding black-boxed scientific claims of risk assessment models in order to see how they codify and quantify the fenceline. The Camp Minden Dialogue is an example of a forum for the institutional organization of fenceline knowledge and expertise embodied by the Concerned Citizens of the Camp Minden M6 Open Burn. On the Navajo Nation, groups like the Forgotten People, Black Mesa Indigenous Support, and the Black Mesa Water Coalition testify to the undertaking of the institutional organization of fenceline expertise.

Sharing fenceline expertise creates solidarity and connections among groups of people adversely effected by industrial pollution. Minden's challenge to the open burning ground paradigm is evidence of how one community's struggle can impact another. Fenceline activists at Holsten Army Ammunition Plant are offering resistance to open burning, citing the developments at Minden. The Ceasefire Campaign illustrates the emergence of a national coalition after Minden. EPA is taking this coalition seriously as evidenced by their Superfund Bulletin which mentions the formation of a national coalition pushing for policy changes to end open burning of hazardous waste munitions.<sup>496</sup> The American Chemical Society letter specifically recognizes the work of grassroots organizing at Camp Minden in bringing to attention the issue of open burning to the organization.

In and around the Radford site organization continues. In April of 2016 over 30 people came out to protest open air burning at Radford Arsenal in front of sitting United States' Congressman Morgan Griffith's Christiansburg District Office. Democrats running against Morgan Griffith have called for a ban and moratorium on open air burning at Radford Arsenal as a result of the politicization of open burning. Radford Arsenal officials have promised additional air quality monitoring years after the first Environmental Patriots requested it.<sup>497</sup> These developments testify to the power of discourse and knowledge that fenceline residents can exert when their expertise is organized.

I selected the three cases for a variety of reasons. The lack of available research about Radford, missing accounts for the genesis and development of the coal slurry line, and innovative developments at Camp Minden were among the many reasons for choosing these cases. Existing scholarship in STS has largely focused on large nuclear facilities. There is deficit of scholarship around active and currently producing Government Owned-Corporately Operated, military-industrial facilities like Radford Arsenal or the Louisiana Army Ammunition Plant.

I argued that a cartography of environmental permitting processes ought to be developed as part of contemporary frontiers of interdisciplinary scholar-activist research around industrial polluting sites. The sharing of information, tactics, and experiences enables fenceline communities to have a greater chance to build momentum to address local environmental justice issues while simultaneously organizing global solidarity through the sharing of fenceline knowledge and expertise with other groups facing similar environmental justice issues.

Fenceline expert knowledge from an individual site can be organized into a global expertise that mobilizes the benefits of institutional structure (dissemination and momentum) while

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496 United States Environmental Protection Agency, "Coalition Pushes to End EPA Policy Allowing Open Burning of Munitions."

497 Mike Gangloff, "More Air Testing at Radford Arsenal Promised," *The Roanoke Times* May 12, 2016.

simultaneously retaining the important contributions of local knowledge. Institutionalization of scholars-activist research can withstand the limitations of the singular researcher by preserving fenceline history and experience. Institutionalization of fenceline knowledge and expertise affords greater resources, helping to overcome and transcend the fragmentation and isolation that fenceline residents often experience.

This approach tries to take from the benefits that institutions afford, namely a structure which withstands the limited longevity of the individual, while maximizing a commitment to expert fenceline knowledge as relevant and important. Having a research agenda that aims to compile, organize, categorize, and genealogically study risk assessments empowers fenceline knowledge and expertise.

Organizing vast repositories of knowledge about risk, methods of organizing, successes, and valuable learning moments in failure become accessible to divergent actors in many different fenceline situations. The study of risk from the fenceline-up enables a cataloging of fenceline knowledge and expertise that can become codified and communicable as residents enter and leave a fenceline community. No better evidence of this is the Camp Minden Dialogue and its success to find and implement alternatives to reduce risks on the fenceline. The administrative record testifies to the preservation of fenceline concern.

A program of research on the fenceline allows for dissemination of shared stories and connection to other local experts who can assist communities facing unique risks from their location next to hazardous activities. A genealogy of experience in fenceline communities can help to provide a body of scholarship with a defined normative goal and researcher solidarity to fight for fenceline residents in their struggle for environmental justice. Community members, who may be fenceline residents, but have no knowledge of the industrial complex, can tap into knowledge communicated specifically for them so that they can understand their neighboring polluting site. This is the role of the scholar-activist; a communicator who straddles the boundary between esoteric expert and engage public intellectual. Through the activation of fenceline knowledge and expertise concerned citizens can influence the politics of risk and knowledge to implement less hazardous solutions to socioenvironmental problems on the fenceline. Minden is a shining example of how this process can occur.

### ***Making Methodological Sense of the Meta-Analysis of the Risk on the Fenceline:***

In “Principles of Critical Discourse Analysis,” Teun van Dijk states that discourse analysis is useful in the critique of “typical macro-notions, such as group or institutional power and dominance.”<sup>498</sup> Sociologists have analyzed macro-notions of a group or institution since the discipline’s inception in the structural functionalist tradition of Durkheim. While macro-level accounts are useful, these accounts are critiqued often for their broad normative notions that ignore individual choices, identities, feelings, and local knowledge through their focus on abstract institutions.<sup>499</sup> I resolve this tension by adopting a discursive method of the study of risk by mobilizing the idea of the fenceline expert.

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498 van Dijk, 301.

499 See the works of the Karl Marx and the Frankfurt School: Herbert Marcuse, Martin Heidegger, Max Horkheimer, and Theodore Adorno.

One of the main methodological challenges I faced was effectively managing how research can move between internal institutional discourses generated within esoteric publications at Radford Arsenal to the macro-level critiques of open burning and its impacts on the fenceline. I could have stayed within Radford's internal discourse about assumptions of risk, but living the experience of risk contributed valuable insight into my personal experience of risk at the fenceline. Therefore, I combine both discourse analysis with observable experiences of risk so as to address researcher bias by those (positivists) who will attack this study as idiosyncratic and not generalizable because of its narrative structure.<sup>500</sup> Instead, I argue that the fenceline is a concept that is excluded from the dominant ways of assessing risk. By including the fenceline standpoint our accounts of risk on the fenceline is significantly strengthened.

I employed a micro-to-macro analysis beginning with risk and fenceline knowledge and expertise. By navigating from the micro to the macro I establish meaning about the nature of risk at the open burning ground to show how the dynamics of such an activity transcends to major insights about the operation of the US war machine and its relationships with fenceline members. I suggest the value of internalist discourse, public outreach, and scholar-activist accounts as central to a rebalancing of expert fenceline knowledge as epistemologically equal to the knowledge of the risk assessment by pointing to the assessments inadequacies and contested nature.

Paulo Escobar in *Encountering Development: The Making and Unmaking of the Third World*, describes institutional ethnography.<sup>501</sup> Escobar states:

The daily practices of institutions are not just rational or neutral ways of doing. In fact, much of an institution's effectiveness in producing power relations is the result of practices that are often invisible, precisely because they are seen as rational. It is then necessary to develop tools of analysis to unveil and understand those practices.<sup>502</sup>

Like Escobar, who cites the work of Dorothy Smith, I began from the assumption that Ethnomethodologists articulate, that organizational texts cannot be taken as "objective" records of external reality but are rather understood in relation to organizational uses and goals in their context or production and interpretation.<sup>503</sup> Discourse is:

...by no means innocuous. [Discourse] is embedded in external social relations and deeply implicated in mechanisms of ruling. Through [discourse] [...] the internal processes of organizations are linked to external social relations involving governments, international organizations, corporations, and communities in the Third World.<sup>504</sup>

Thus "from the perspective of institutional ethnography, a local situation is less a case study than an entry point to the study of institutional and discursive forces and how these are related to larger socioeconomic processes."<sup>505</sup>

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500 See the work of Thomas A. Schwandt on positivists and positivism in, "Three Epistemological Stances for Qualitative Inquiry: Constructivist, Interpretivism, Hermeneutics, and Social Construction," in *Handbook of Qualitative Research*, 2nd Edition, edited by Norman K. Denzin and Yvonne S. Lincoln, (Thousand Oaks, CA: Sage, 2000).

501 Arturo Escobar, *Encountering Development* (Princeton University Press, 1994), 105.

502 Ibid.

503 Ibid., 108.

504 Ibid. 109-110.

505 Ibid., 109.

My examination of the discursive conceptions of fenceline risk in these three cases articulates experiences of how sociotechnical processes intersect communities by creating risk. I situate micro-level fenceline analysis in context to macro-level social institutional critiques of coal mining industry and the military industrial complex in the tradition of the Frankfurt School to make a critique of the mining and munitions industry.<sup>506</sup>

I have shown how fenceline community members are not powerless to resist the conditions of bureaucratic knowledge tyranny so eloquently put by Max Weber. Weber states, “Bureaucratic administration means fundamentally domination through knowledge.”<sup>507</sup> Fenceline knowledge and expertise have the capacity to challenge the domination of knowledge through bureaucratic administration by directly intervening in the construction of knowledge and risk. Fenceline knowledge can be more legitimate than any bureaucrat’s knowledge especially if presented in the right way. When people see plumes moving over elementary schools it is very difficult for bureaucrats to ignore especially in the cases of public outcry. The concerned citizens at Minden were able to mobilize to public outcry to their advantage to reduce risk.

Reflexively, my agency in ordering, selecting information, and relating the data within a narrative structure leads to some concerns about the conduct of history and sociology, namely, what is the condition of author bias? Hayden White in *The Content of the Form: Narrative Discourse and Historical Representation* cautions practitioners:

Thus envisioned, the narrative figurates the body of events that serves as its primary referent and transforms these events into intimations of patterns of meaning that any literal representation of them as facts could never produce. This is not to say that a historical discourse is not properly assessed in terms of the truth value of its factual (singular existential) statements taken individually and the logical conjunction of the whole set of such statements taken distributively. For unless a historical discourse acceded to assessment in these terms, it would lose all justification for its claim to represent and provide explanations of specifically real events.<sup>508</sup>

White points to a fundamental problem with regards to the narrative form in the construction of historical discourse. The problem concerns the production of “truth” when the researcher utilizes narrative. I have utilized a narrative structure to organize a series of signifiers. Roland Barthes states in “Le discours de l’histoire”:

In the historical discourse of our civilization, the process of signification is always aimed at ‘filling out’ the meaning of History. The historian is not so much a collector of facts as a

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506 In order to bridge the micro/macro divide, I fundamentally adopt the method of Roland Barthes in his essay “Le discours de l’histoire”: He states, (my translation) “in the historical discourse of our civilization, the process of signification is always aimed at ‘filling out’ the meaning of History. The historian is not so much a collector of facts as a collector and relater of signifiers; that is to say, he organizes them with the purpose of establishing positive meaning and filling the vacuum of pure, meaningless series.” Roland Barthes, “The Discourse of History,” *Comparative Criticism: A Year Book*, trans. Stephen Bann, vol. 26, ed. E.S. Schaffer (Cambridge, 1981) 17. Thus I am relating a series of texts on the discursive level to establish continuity between ideas emanating from the same historical era. I am aware that the bridge from micro to macro is tumultuous, but I let the texts speak for themselves in relation to each other with openness as the organizing agent.

507 M. Weber, G. Roth, and C. Wittich, *Economy and Society: An Outline of Interpretive Sociology* (University of California Press, 1978), 225.

508 Hayden V. White, *The Content of the Form: Narrative Discourse and Historical Representation* (Baltimore: Johns Hopkins University Press, 1990), 45.

collector and relater of signifiers; that is to say, he organizes them with the purpose of establishing positive meaning and filling the vacuum of pure, meaningless series.<sup>509</sup>

The previous pages are an organization and analysis of discourse, personal experience, and history. In adopting a first person narrative structure by ordering and relating the signifiers of risk analyses, permits, newspaper articles, community meetings, Environmental Patriots meetings, and many conversations with those living on the fenceline, I document challenges to the regulatory and production expert politics of risk found in all three of these cases.

I represent the signifiers of a narrative about risk of mining and open burning explosives waste. I have told one possible history behind the expired permit for the open burning operation that continues to operate near my home on the fenceline. I order the discourse to support the narrative that more inquiry into the relationships of knowledge, technology, science, expertise, and local knowledge should be conducted to privilege the standpoint of those who live in close proximity to dangerous, risky facilities. I show how fenceline residents have a stake in shaping how knowledge is constructed on the fenceline to better understand the consequences of high risk technology.

How does this process affect factual or accurate criteria of the work? White's thesis points precisely to this point: given that we use narrative to present meaning in history, our work is still evaluated in terms of its ability to convey "Truth" when our narrative structure is largely the result of the practitioner's goals and interests in her or his work. This is a fundamental dilemma that scholar-activists face, namely, the tension between factual representation and the idiosyncratic narrative structure employed to tell the story.<sup>510</sup> Linda Smith suggested in her work to reconceptualize the norms of scholarship away from objectivity and truth and toward communication. I have attempted to strengthen objectivity by including the fenceline standpoint to suggest that communication across these spaces is fundamentally important to empowering the communities who live amidst some of the riskiest systems in the country. I have tried to share experience and knowledge of over 3 years of scholar-activist engagement within three fencelines. I argue that beginning research from the standpoint of the fenceline enables greater clarity within the study of risk to empower environmental justice in fenceline communities.

In light of the contestations about the production of truth, in historical-sociological qualitative research, I turn to what Rebecka Lennartsson articulates as the fundamental problem of doing qualitative work grounded in the past. She states, "A field worker of the past must reconstruct the world he or she intends to examine. It does not exist, ready for the researcher to inhabit."<sup>511</sup> The very problem that has been discussed by Barthes and White stems from Lennartsson's identification of not being able to inhabit the place of inquiry when conducting historical research.<sup>512</sup> The ability to articulate the past, with the contestations over representation

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509 Roland Barthes, "The Discourse of History," *Comparative Criticism: A Year Book*, trans. Stephen Bann, vol. 26, ed. E.S. Schaffer (Cambridge, 1981) 17.

510 See page 120-121 of Michelle Fine et. al. "For Whom? Qualitative Research, Representation, and Social Responsibilities." in *Handbook of Qualitative Research*, 2nd Edition, edited by Norman K. Denzin and Yvonne S. Lincoln, (Thousand Oaks, CA: Sage, 2000) for a detailed explanation of the dilemmas faced by qualitative researchers with regards to representation.

511 Rebecka Lennartsson. "Notes on 'not being there': Ethnographic Excursion in Eighteenth-Century Stockholm." *Ethnologia Europaea* vol. 41, no. 1, (2011): 108.

512 This is not to say that places that can be experienced do not suffer from their own problems of representation. Historical research involves a further problem with regard to representation.

in mind, stems from the discursive turn in qualitative research. Lennartsson states, “As Norman Denzin observes, we do not study lived experience, we examine lived textuality.”<sup>513</sup> My work embodies Denzin’s formulation as my study broadens his notion to include the lived textuality of risk on the fenceline.

I therefore rely upon textuality, but also lived and shared experience. I cannot grasp what it was like to live in days of building the slurry line, the costs of relocation, the decision to open burn at Minden, the construction of RAAP, as if I was present or in the “field.” However, I relate texts to one another providing a glimpse at one possible representation to understand and offer a model of scholarship that seeks to preserve the scholar-activist component that was in the spirit of the founding of STS as a discipline.

While many more accounts of all three cases are possible I have presented this research in a reflexive way. I articulate a particular narrative to give order to the texts I have put into conversation and recognize the methodological challenges of doing historical research. Rather than one “Truth” I offer a glimpse into one of many possible “truths” of fenceline experience. Given the structure of a dissertation and the constraints of time I have selected risk as the criteria for adjudicating which primary source documents to include and which ones to exclude. As a result of the question of inclusion and exclusion of certain source material historical and sociological qualitative accounts will widely vary depending on which body of literature the researcher prioritizes.

I am ultimately responsible for those decisions as the author of this work. Likewise Barbara Tedlock in “Ethnography and Ethnographic Representation,” explains, “The shift from an objectifying methodology to an intersubjective methodology entails a representational transformation. The exploration of ethical issues involved in the process of generating ethnographic information and publishing ethnographic accounts encouraged ethnographers to combine the political, philosophical, and personal within single accounts.”<sup>514</sup> My account includes aspects of the political, philosophical, and personal by the very choices I made in the narrative construction.

### ***Future Directions***

This research offers a synthetic account of fenceline experience in context to a description and theory of what is at stake in the construction of risk on the fenceline. I seek to empower intervention strategies to help those most impacted by the politics of knowledge and risk on the fenceline. I mobilize the concept of the fenceline to empirically situate how this standpoint can strengthen our understanding of the political contestations of the construction of knowledge and risk of sociotechnical systems for those living in closest proximity to hazards. Including the standpoint of fenceline expertise and knowledge within the study of risk enhances our understanding of socially situated knowledge at pollution locations. Fencelines are contested sites of knowledge creation for those living the experience of risk. Theorizing the fenceline broadens our understandings of the conditions within polluted and toxic landscapes.

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513 Rebecka Lennartsson. “Notes on ‘not being there’: Ethnographic Excursion in Eighteenth-Century Stockholm.” *Ethnologia Europaea* vol. 41, no. 1, (2011): 109.

514 Barbara Tedlock, “Ethnography and Ethnographic Representation,” in *Handbook of Qualitative Research*, 2nd Edition, edited by Norman K. Denzin and Yvonne S. Lincoln (Thousand Oaks, CA: Sage, 2000) 471.

I argued for the creation of a research program that studies the social construction of fenceline risk: **Critical Risk Analysis (CRA)**. This approach deconstructs regulatory and producer risk assessments as socially situated political tools of expert knowledge that embed a weak understanding of the hazards of sociotechnical risk. CRA seeks to offer a praxis oriented approach toward empowering environmental justice by calling into question the adequacy of risk assessments. I demonstrate the politics informing the inclusion and exclusion of data, expertise, and knowledge which define an assessment of risk. Critical Risk Analysis activates the fenceline standpoint by calling for the full participation of fenceline residents within the decisions to define, adjudicate, and designate criteria for the assessment of risk through the testing, monitoring, and assessment of fenceline data and discourse. Such an approach broadens our objectivity of fenceline conditions while simultaneously working to reduce harm.

The proliferation of risk inequalities, unknowns, ignorance, and denial of the harmful consequences associated with the anthropogenic sociotechnical systems necessitates a program of research that seeks to better clarify the experience of risk for communities on the fenceline. As evident by the City of Flint lead drinking water tragedy the failure of neoliberal state-regulators and producers to protect human health dictates a more objective study of how the means to determine and produce risk knowledge and expertise are political decisions with great consequences and impact to the lives of those who live closest to the most toxic spaces. Rather than ceding cognitive sovereignty to these regulators and producers, the activation of fenceline knowledge and expertise seeks to study risk on our own terms by mobilizing our standpoint.

By proximity fenceline inhabitants live in spaces with the most direct threats and consequences of a permitted high-risk activity. Fenceline residents often lack access to and familiarity with technology and specialized knowledge needed to understand risk. Their lives confront the greatest threat from the consequences of industrial activities near their homes. An analysis of macro-concepts, such as the politics of risk and knowledge within these marginalized spaces, reveals the importance of the beginning from the standpoint of the fenceline in context to the study of risk. Contributions of the fenceline ought to be incorporated within every assessment of risk through the critical activation of the expertise of fenceline knowledge and experience.

Further theorization of the fenceline is needed. Confronting the harsh living conditions of fenceline reservation life through the lived experience of working alongside traditional Navajo people was critical to the beginnings of this dissertation. Ironically, in Black Mesa, besides the HPL/NPL fence, and a few fences around Peabody's core assets, there is little physical barrier to keep from walking into the active mining area. However, there is a clear consciousness among many people that live within this space that they face immediate and direct consequences from extraction. Thus in many cases, the fenceline is a metaphorical concept to situate the space where risk is unevenly concentrated. The idea of the fenceline is a useful model to situate the crucial physical space near high-risk technology and the structural inequalities of risk created by living within physical proximity to polluting industry.

In the Anthropocene the threats faced by local fenceline communities are increasingly generalized across the globe and decontextualized from their source point. The Nevada Test Site is an example of how activities on the fenceline effected distant communities by spreading nuclear fallout across the country. How do continued emissions of greenhouses gases create risk of sea level rise for those living far away fossil fuel production? The laboratorization of the world through anthropogenic sociotechnical systems decontextualizes risk from the local to the planetary. How



do pollutants migrate vast distances across space effecting communities far from the spaces of their production? The Anthropocene challenges the idea of the fenceline by increasing the decontextualization of risk from specific local locations to the planetary level. For example, the construction of large natural gas pipelines in Appalachia creates a risk corridor hundreds of miles long across many diverse communities. Where does the concept of the fenceline start and end? These questions suggest more empirical work needs to be conducted on how residents living next to high risk technology conceptualize the space of the fenceline in context to distant anthropogenic high risk systems that decontextualize risk from the local to the global.

Moreover, the solution to pollution is dilution paradigm, is coming under scrutiny. Humanity's technological omnipresence is stretching the capacity for pollution dilution into the atmosphere, oceans, and freshwater. Scientific knowledge of socioenvironmental pollution increasingly understands the limitations of just how much pollutants the atmosphere and water can absorb without drastic and deadly consequences for life on Earth.<sup>515</sup>

Despite the planetary socioenvironmental impacts from anthropogenic production, the notion of the fenceline is still particularly useful to frame a local analysis of risky spaces in context to environmental justice. The unevenness in the concentration of risk makes the concept useful. Further scientific and sociological research is needed to better develop a theory of the fenceline in a broader context offered by these three cases.

My experiences challenged me to understand how the fenceline challenges residents. In Black Mesa traditional ways of indigenous life are under attack by industrial activities in the Four Corners region. We witness similar sufferings in the fenceline around RAAP where residents are increasingly questioning the safety of their soil, air, and water. Thyroid cancer incidence rates are very high in the counties surrounding RAAP.<sup>516</sup> More research needs to be conducted to enroll fenceline community member participation in order to better understand and situate the risks from these toxic sites.

Fenceline perspectives significantly strengthen how we understand risk. People living next to polluting facilities ought to empower themselves to understand their lives in relation to the hazards of polluting facilities. For example, in Black Mesa, coal producers tried to disregard the fenceline knowledge and expertise of how coal extraction effected the landscape. Energy and water producers caused the suffering of the traditional Diné people within the extraction space. Local land was desecrated, blown up, and contaminated, leading to health problems and livestock death while maximizing the comforts of those far away from the extraction operations.

The accounts mobilized by neoliberal regulators and producers stand in stark contrast to the accounts of fenceline residents. Regulators and producers claim that nothing harmful is happening from releases or active production. They claim that risk is tolerable and hazards are controlled despite a lack of empirical evidence to substantiate their claims.

Fenceline residents recount an entirely different story. Fenceline residents must seek to empower themselves. Bureaucracies like the EPA's Office of Civil Rights were created within the

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515 See: Christophe McGlade and Paul Ekins, "The Geographical Distribution of Fossil Fuels Unused When Limiting Global Warming to 2 Degrees C," *Nature* 517, no. 7533 (2015). Stephen G. Colt and Gunnar P. Knapp, "Economic Effects of an Ocean Acidification Catastrophe," *The American Economic Review* 106, no. 5 (2016)., Katarzyna B. Tokarska et al., "The Climate Response to Five Trillion Tonnes Of carbon," *Nature climate change* 6, no. 9.

516 See figures for the thyroid cancer incidence maps.

context of President Bill Clinton's Executive Order 12898 on Environmental Justice. However, in the 22 years since the signing of the order no enforcement has occurred. For example, according to a recent Center for Public Integrity report, in the 22 year history of the EPA's Office of Civil Rights investigating Title VI environmental racism civil rights complaints they have never issued a formal finding of a Title VI violation for environmental racism.<sup>517</sup> Environmental justice looks good on paper, but it is rarely sought by producers and regulators.

The failure of existing regulatory environmental justice advisement requires innovation. Fenceline residents should seek to activate their perspectives through knowledge and expertise. Critically analyzing risk assessments and environmental discharge permits reveals how regulatory and production experts quantify risk in the fenceline. By activating the valuable contributions of fenceline knowledge, experience, and expertise in context to the inadequacies of existing regulatory and producer risk assessments, fenceline residents can empower a more objective scientific study of the experience of exposure to toxicity. For example, fenceline residents help to empower scientists to put their scientific expertise to work in service of humanity. Dr. Salvatore's intervention and the American Chemical Society's letter challenging open burning were strengthened by fenceline organizing against open burning at Minden.

The laboratorized conditions on the fenceline necessitates further social and scientific inquiry into the environmental chemistry and epidemiology of these spaces to empirically ground and strengthen the optical resolution of the objective impacts of risk. Studies should seek to enroll participation of fenceline residents directly into the research projects of scientific and technological experts. The expertise and knowledge of the fenceline standpoint is primed to better resolve the impacts of risk when fenceline perspectives are included within the design of scientific studies of risk. The fenceline standpoint providing insight into the daily experience of life next to high-risk systems of production and will help to create better systems of study to assess fenceline risk.

For example, a large body of technical research is developing wearable, wirelessly networked, air monitoring technologies. Future directions of this research should investigate how fenceline communities can deploy next generation air and water monitoring sensors in pursuit of environmental justice. Fenceline expertise and knowledge should actively be enrolled into the process of the design of the wearable environmental monitoring technology.<sup>518</sup> Strengthening fenceline knowledge and expertise through empirical analysis will strengthen the objectivity of fenceline citizen science.

Quantitative analysis and data collection of fenceline experience with risk is needed to assist residents to gather the data necessary to challenge regulatory and production expertise. Fenceline residents know exactly, from their daily experience with risk, when and where to deploy

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517 Kristen Lombardi, Talia Buford, and Ronnie Greene, "Environmental Racism Persists, and the EPA Is One Reason Why," The Center for Public Integrity, <https://www.publicintegrity.org/2015/08/03/17668/environmental-racism-persists-and-epa-one-reason-why>. Albert Huang, "The 20th Anniversary of President Clinton's Executive Order 12898 on Environmental Justice," National Resources Defense Council, <https://www.nrdc.org/experts/albert-huang/20th-anniversary-president-clintons-executive-order-12898-environmental-justice>.

518 See: R. Piedrahita et al., "The Next Generation of Low-Cost Personal Air Quality Sensors for Quantitative Exposure Monitoring," *Atmospheric Measurement Techniques* 7, no. 10 (2014); F. Tsow et al., "A Wearable and Wireless Sensor System for Real-Time Monitoring of Toxic Environmental Volatile Organic Compounds," *IEEE Sensors Journal* 9, no. 12 (2009). Cheng Chen et al., "A New Sensor for the Assessment of Personal Exposure to Volatile Organic Compounds," *Atmospheric Environment* 54 (2012).

monitoring technologies. Industry is already recognizing how this approach will challenge the dominate model of environmental compliance and risk management. For example, Delmer Ehrich states,

The rise of citizen science will pose major challenges to industry in environmental permitting, compliance, enforcement and risk management. Fueled by advances in information and monitoring technologies, adapted by a public that is concerned about its “personal environment,” and fostered by the U.S. Environmental Protection Agency, citizen science is starting to generate data that does not fit easily into the traditional environmental compliance and risk management model.

Innovations of advanced monitoring technologies and real-time reporting through the rapid deployment of next generation air monitors offers the potential to significantly empower our fenceline communities to create our own knowledge, expertise, and science from our standpoint in order to directly intervene within the context of regulatory and producer knowledge claims.<sup>519</sup> Furthermore the sharing and the development empirical monitoring analysis of our experience with risk can assist other fenceline communities grappling with the design of monitoring systems and assessment protocols.

Traditionally, regulatory and production experts have exerted considerable monopolies on resources, knowledge, and expertise. Fenceline communities have often lacked access to the tools, resources, science, technology, data, monitoring equipment, and institutional resources to understand how industrial processes risk their lives. However a new model is in the process of developing. Emily Snyder et al., argues:

Historically, approaches for monitoring air pollution generally use expensive, complex, stationary equipment which limits who collects data, why data are collected, and how data are accessed. This paradigm is changing with the materialization of lower-cost, easy-to-use, portable air pollution monitors (sensors) that provide high-time resolution data in near real-time. These attributes provide opportunities to enhance a range of existing air pollution monitoring capabilities and perhaps provide avenues to new air monitoring applications. Sensors tied to advances in computing and communication also provide enhanced availability and accessibility of air monitoring data.”<sup>520</sup>

New technological innovations promise to democratize the technologies of environmental monitoring. Fenceline access to technologies of next generation air monitors will help to significantly strengthen our objectivity of the pollution and risk on the fenceline.<sup>521</sup> The EPA is pursuing the paradigm shift toward real-time, quickly deployable monitoring technology. In August of 2016, a 4.5 million dollar research project was announced to “...develop and use low-

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519 United States Environmental Protection Agency, "Citizen Science Fact Sheet," in *Science in Action: Innovative Research for a Sustainable Future* (March 2015).

520 Emily G. Snyder et al., "The Changing Paradigm of Air Pollution Monitoring," *Environmental Science & Technology* 47, no. 20 (2013).

521 George Lane, "Air Quality Issues Air Monitoring Needed for Cleanup Workers in Vessels," (Deepwater Horizon Study Group, January 2011).

cost air pollution sensor technology, while engaging communities to learn about their local air quality.<sup>522</sup>

Further research in Differential Mobility Spectroscopy, Remote Sensing using Pen-Path Fourier Transform Infrared (OP-FTIR) Spectroscopy, and Photoionization Detection technology are promising arenas of technical research in the creation and deployment of disruptive technologies which promise to significantly aid fenceline empirical environmental monitoring.<sup>523</sup> These technologies use real-time data reporting, maximizing the benefits of wireless networking technology. These technologies will disrupt regulatory and producer experts by empowering the fenceline standpoint. Kumar et al., state:

The idea of ubiquitous sensing (i.e. employing a large number of sensors in a small space) is attracting attention from the air quality management community (Burke et al., 2006; Cuff et al., 2008), particularly given the high availability, low cost and miniaturisation of sensors, which allows them encompass a wider area of the urban environment at a fraction of the cost of conventional instruments (Chong and Kumar, 2003). The development of these sensors has led to a paradigm shift in fine-grained air quality data collection from static and mobile configurations that were not feasible just a few years ago. Moreover, many of these sensors do not require specialised knowledge to be deployed, which encourages public participation in the process (Paulos et al., 2009) and has given birth to the concept of community-based monitoring (Air Quality Egg, 2014), which is driven by local information needs and community values.<sup>524</sup>

Wearable ubiquitous sensing technologies will offer a new empiricism for fenceline monitoring. From the standpoint of fenceline empiricism, the democratization of environmental data collection will empower our interventions to challenge the reduction of our lives in permit and risk assumptions. Fenceline research should actively seek to work with engineers and scientists to construct technologies that prioritize the fenceline standpoint.

Creating fenceline knowledge and expertise through discursive and empirical analysis constitutes one approach to citizen science. Innovations of advanced monitoring technologies and real-time reporting promised by rapidly deployable next generation air monitors will allow fenceline communities to create our own knowledge, expertise, and citizen science from within our standpoint. The fenceline standpoint empowers our interventions to challenge the reduction of our lives in permit and risk assumptions. Risk assessments codify the laborization of the fenceline by ordering what variables are deemed relevant for inclusion vis-à-vis those that are excluded. No longer will fenceline residents have to outsource their cognitive sovereignty to the hands of neo-liberal producers and regulators who exert monopolistic control over the means of environmental data production. Instead we will be able to gather the data needed to empirically engage the politics of knowledge and risk on the fenceline by mobilizing our immediate and

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522 United States Environmental Protection Agency, "EPA Awards \$4.5 Million to Advance Air Monitoring Technology," United States Environmental Protection Agency, <https://www.epa.gov/newsreleases/epa-awards-45-million-advance-air-monitoring-technology>.

523 C. Schütze and U. Sauer, "Challenges Associated with the Atmospheric Monitoring of Areal Emission Sources and the Need for Optical Remote Sensing Techniques—an Open-Path Fourier Transform Infrared (Op-Ftir) Spectroscopy Experience Report," *Environmental Earth Sciences* 75, no. 10 (2016).

524 Prashant Kumar et al., "The Rise of Low-Cost Sensing for Managing Air Pollution in Cities," *Environment International* 75 (2015): 202.

grounded fenceline standpoint to the design of scientific inquiry. When we see an emission or a plume, we will be able to measure it and share our analysis with others. This data will help fenceline residents challenge the claims of polluters. Higher resolution technologies deployed from the fenceline will contest regulator expertise by opening news spaces for researchers to work with fenceline communities to better document and assess risk.

In conclusion, my experience in context to the three risk regimes of large scale sociotechnical systems propelled me to ask questions about how risk can be mitigated and better assessed from the perspective and standpoint of the people who confront most directly the pollution near their homes. Experience working as a legal researcher on the reservation opened new perspectives. This practice acclimated me to the longtime activist struggles for indigenous' rights and environmental justice. Studying the production of secrecy and ignorance around RAAP's open burning ground, I used my experience on Black Mesa to inquire into the construction of risk from the large scale sociotechnical system upwind from Blacksburg and Virginia Tech in Southwest Virginia. Studying the social construction of risk reveals a proliferation of unknowns confronted within many fenceline communities. More theorization and empirical study of fenceline communities is needed to maximize the explanatory potential and stronger objectivity of research from the fenceline standpoint. Fenceline residents should be given priority in access to new technologies for data collection. Their standpoint is uniquely capable to socially situating new technologies of environmental monitoring and risk research.

Through an analysis of risk assessments at the open burning ground I set the stage for future documentation of shared experiences, narratives, and stories of struggle for environmental justice that I encountered as a scholar-activist throughout my time on this project. This dissertation argues that fenceline community members are best served when they are included in the decision making process. Knowledge sharing and dissemination are the normative commitments which assumes that with better and more inclusive knowledge communities will be able to make better decisions with regards to the sociotechnical practices that generate risk within our fencelines.

The organization of the community in the Black Mesa mining area, bounded in a birthright claim to the land, relationships with one's neighbors dating back generations, and the work of many people worked to terminate one of the most destructive sociotechnical systems in the region: The Mojave Generating Station and its coal slurry pipeline. Their success inspired me to see the power of an organized fenceline community knowledge and expertise. The Bennett Freeze has ended change is in the air on the reservation.<sup>525</sup>

The work of the dedicated fenceline citizens of Camp Minden to effectively resist the operation of new open burning in their community shows the power organized fenceline residents can achieve in negotiating sociotechnical solutions to risk. Minden testifies to the resiliency and determination of engaged stakeholders at the center of contestations of risk.

The movements against coal slurry and open burning grew their own momentum. The risk of open burning is propelling a social movement that challenges the practice as an acceptable means of hazardous waste disposal. The Minden Dialogue shows how robust fenceline

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525 On Feb, 3rd 2016, the Navajo Nation Council passed the largest single largest spending package in its history, from a settlement the tribe received from a federal lawsuit. Please see: Ryan Heinsius, "Water and Sanitation Bill Largest-Ever Spending Package Passed by Navajo Council," KNAU, <http://knau.org/post/water-and-sanitation-bill-largest-ever-spending-package-passed-navajo-council#stream/0>.

participation can enable better sociotechnical practices. Sociotechnical decisions are made safer when the safety and risk concerns of the fenceline standpoint are at the center of the decision making process. The dialogue achieved a stronger objectivity by including many perspectives and standpoints to assess the risk of open burning on the Minden's fenceline.

Frances Kelly's letter articulates the commitment to greater democratic participation in the decisions which impact our environment and health. Both Kelly and Salvatore mobilize discursive opposition to an existing technological proposal by referencing the existential threat to health and safety that open burning will have on fenceline residents. Their voices, among the thousands at Camp Minden, were included in the decision making process to implement the world's most advance contained burn structure because they had the courage to participate.

Through the work of Devawn Bledsoe and the Environmental Patriots of the New River Valley the same process may just yet occur on my fenceline. Scientists, engineers, activists, regulators, scholars, and fenceline residents who publically take the path of risky intervention are the true heroes of this dissertation. Through their dedication they create the conditions to reduce risk and maximize benefits.

Dedicated fenceline activists generate the conditions to create alternatives to risky technological practices on the fenceline. The work paved by those brave enough to engage at Black Mesa, Radford, and Camp Minden promise to make our world a better place in the fight for environmental justice.

**Figures:**



*Figure 1: Coal Fire Emissions on the Fenceline*



Figure 2: Entering the Fence at Black Mesa's Kayenta Mine





*Figure 3: Coal Slurry Pipeline Indicating Route Next to Fenceline Residences*



*Figure 4: Juxtaposition between the Mine in the Background, without Trees, and Non-Mined Landscape in the Foreground*



*Figure 5: Damage to Fenceline Home from Blasting on the fenceline; No Electricity in Home Next to Mine Providing Electricity*



*Figure 6: Entering the Slurry Complex at Black Mesa*



*Figure 7: Water Well on the Fenceline*



*Figure 8: Coal Stock Pile near the Fenceline*



*Figure 9: Coal Slurry Tank Next to Fenceline Home*



*Figure 10: Black Mesa Coal Slurry Complex Next to Fenceline Home*





*Figure 11: Failed Reclamation, No Trees Growing*



*Figure 12: Dragline in Operation Next to Fenceline Home*



*Figure 13: The Legal Researcher on the Fenceline with San Francisco Peaks in the Background*



*Figure 14: Mining Operations*



*Figure 15: Dismantled Water Tank in Black Mesa*



*Figure 16: Proximity of Fenceline Residence to Active Coal Operations (Coal Processing Dome in the Background)*



*Figure 17: Black Mesa Mine Sign Boundary*



*Figure 18: Peabody Public Water Station Showing Water Hauler*





*Figure 19: Mined Land Juxtaposed with Unmined Land in the Background*



*Figure 20: Fenceline Residents Grade Their Own Roads*



*Figure 21: Bennett Freeze Housing Conditions*



*Figure 22: Kayenta Mine Conveyor with Coal Silo for Loadout at Electric Railroad for Transport to Navajo Generating Station*



*Figure 23: Layers of Coal Dust in the Snow*



*Figure 24: Coal Slurry Facilities at Black Mesa Complex*



*Figure 25: Coal Processing Facilities*



*Figure 26: Navajo Partitioned Land/Hopi Partitioned Land Fence*





*Figure 27: Chemical Storage Tanks*



*Figure 28: Orange Plume above Tree-line from Open Burning at Radford Arsenal, March 23, 2016:*



**Erin Brockovich**

March 23 · 🌐

Today Radford Arsenal conducted Open Burning of Hazardous Waste. This is drifting over Virginia Tech and Blacksburg. This is one of the most dangerous and toxic facilities in the Nation according to EPA's Toxic Release Inventory and RSEI data.

There is a high level of Thyroid Cancer Incidence in the Region.

We need help to pressure nationwide implementation of contained burn structure technology that has been on the market for over two decades.



*Figure 29: Erin Brockovich Shared Photo from Plume Moving Over Fenceline Community*



*Figure 30: Open Burning Plume at Radford Arsenal from the 2011 EPA Multi-Media Inspection Obtained by FOIA by Environmental Patriots of the New River Valley<sup>526</sup>*

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526 United States Environmental Protection Agency, "Multi-Media Inspection Report US Army Radford Army Ammunition Plant (RFAAP)."



Measure distance  
Total distance: 4.58 mi (7.37 km)

Figure 31: Distance of Virginia Tech from the Open Burning Ground at Radford Arsenal, 4.58 Miles

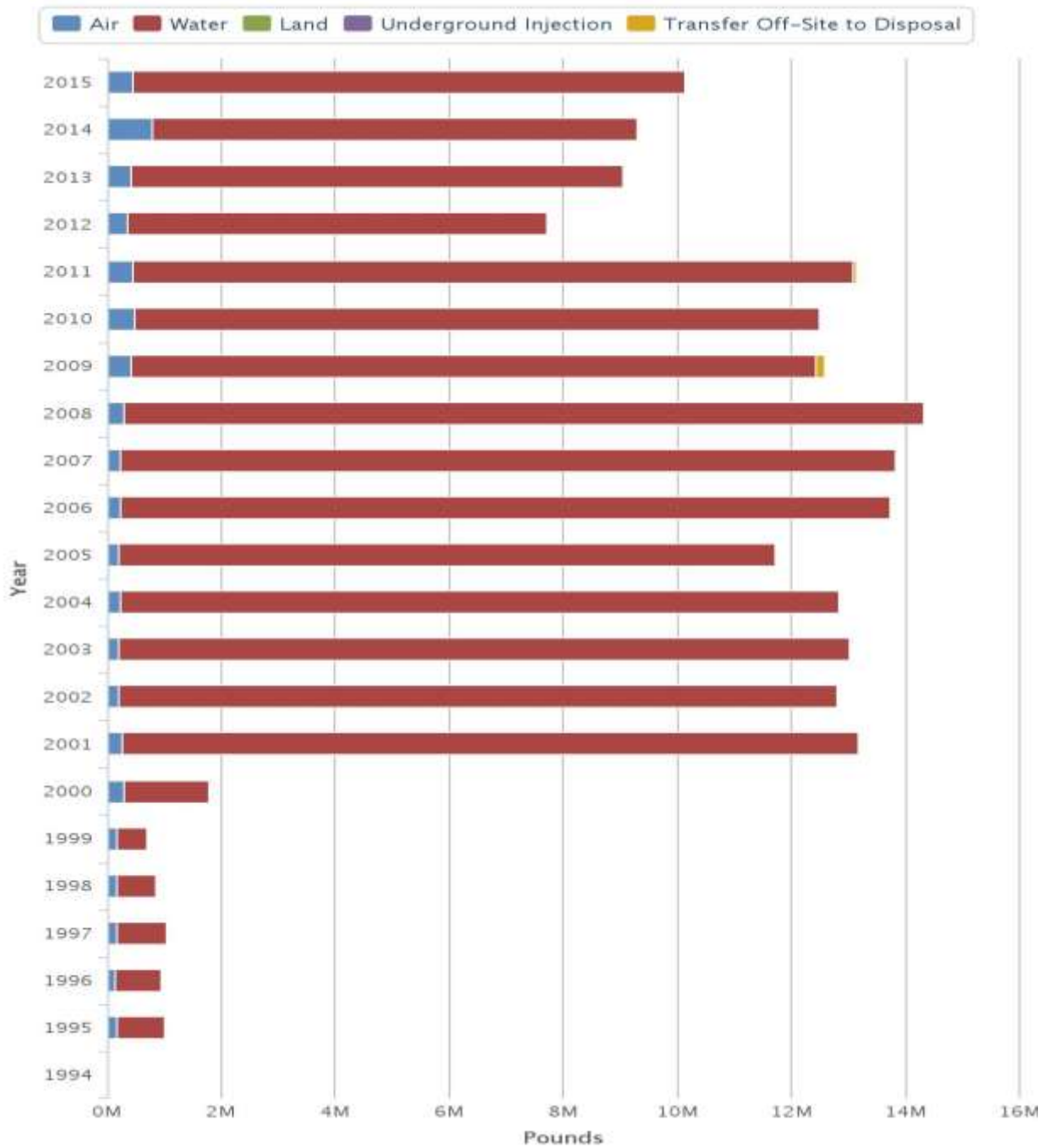


Figure 32: Toxic Release Inventory for the Radford Arsenal (Excludes New River Energetics) Scale: Millions of Pounds<sup>527</sup>

<sup>527</sup> "Toxics Release Inventory Program".

## RSEI Facility Rankings



Select a year to show the facility-level results for the year. Note that, unlike trends (which are limited to chemicals with unchanged reporting requirements over the period), annual rankings include all chemicals reported for the year.

Select Year **2014**

Graphs | **Data**

Select a facility in the table below and click a button at right to see more details on that facility's releases for the year. Media Chemical

**All Facilities:**

Year	Facility ID	Facility Name	ChromHexF	TRI Pounds	Cancer Hazard
2014	77520MBYCR8500W	BAYER MATERIALSCIENCE BAYTOWN	25%	8,101,204	14,275,625,674,540
2014	64120MBYCR8400H	BAYER CROPSCIENCE	25%	4,091,501	3,344,922,919,640
2014	70063DPNTPHIGHW	DUPONT PONTCHARTRAIN WORKS	25%	438,007	312,466,433,905
2014	24141SDDSRPOBOX	US ARMY RADFORD ARMY AMMUNITION PLANT	34%	9,292,749	274,724,713,862
2014	84029SFTYK11600	CLEAN HARBORS ARAGONITE LLC	19%	3,270,610	256,796,364,364
2014	77704DPNTBSTATE	DUPONT BEAUMONT PLANT	25%	2,767,192	220,541,998,603
2014	06383FDRLPINLAN	FUSION PAPERBOARD - CONNECTICUT LLC	34%	280,562	195,407,735,200
2014	24141NWRVRTE11	ALLIANT TECHSYSTEMS OPERATIONS LLC (NEW RIVER ENERGETICS)	25%	362,504	185,831,100,000
2014	77571LPRTC2400M	OXY VINYL LP LA PORTE VCM PLANT	25%	4,254,377	185,192,540,946
2014	77541HNTSM307CO	HUNTSMAN ETHYLENEMINES PLANT	25%	5,689,737	175,018,476,588
2014	32831STNTN5100S	STANTON ENERGY CENTER	18%	890,751	167,293,940,000
2014	42348CNTRY1627S	CENTURY ALUMINUM OF KENTUCKY	3%	1,264,670	160,681,000,000
2014	7515WTRMPH3AUST	TRIUMPH AEROSTRUCTURES RED OAK FACILITY	25%	28,369	160,478,531,875
2014	29602MCPRFPOBOX	CYTEC CARBON FIBERS LLC	34%	641,218	146,405,564,600
2014	3651WTHYSS1THYS	OUTOKUMPU STAINLESS USA LLC	34%	3,658,655	143,866,680,000
2014	83276MNSNTHIGHW	P4 PRODUCTION LLC	25%	275,719	140,601,073,400

Record: 1 of 16694 | No Filter | Search

Export to Excel Export to Text

Figure: 33 2014 Risk Screening Environmental Indicators Overall Cancer Hazard Index for Radford Army Ammunition Plant, BAE Systems at #4 in the United States, and Alliant Techsystems at #8 in the United States for Cancer Hazard<sup>528</sup>

## RSEI Facility Rankings



Select a year to show the facility-level results for the year. Note that, unlike trends (which are limited to chemicals with unchanged reporting requirements over the period), annual rankings include all chemicals reported for the year.

Select Year **2014**

Graphs Data

Select a facility in the table below and click a button at right to see more details on that facility's releases for the year.

Media

Chemical

### All Facilities:

Facility ID	Facility Name	ChromHexF	TRI Pounds	Cancer Hazard	NonCancer Hazard	RSEI Hazard
77520MBYCR8500W	BAYER MATERIALS/SCIENCE BAYTOWN	25%	8,101,204	14,275,625,674,540	333,651,788,607	14,604,680,815,26
64120MBYCR8400H	BAYER CROPS/SCIENCE	25%	4,091,501	3,344,922,919,640	3,465,226,599	3,345,067,555,67
24141NWRVRRTEL1	ALLIANT TECH/SYSTEMS OPERATIONS L	25%	362,504	185,831,100,000	3,119,538	418,668,658,07
24141SDDSRPOBOX	US ARMY RADFORD ARMY AMMUNITION	34%	9,292,749	274,724,713,862	423,140,700	361,193,862,92
70069DPNTPHIGHW	DUPONT PONTCHARTRAIN WORKS	25%	438,007	312,466,433,905	170,879,810	312,824,753,54
84029SFTYK11600	CLEAN HARBORS ARAGONITE LLC	19%	3,270,610	256,796,364,364	3,872,077,100	277,218,112,83
77704DPNTBSTATE	DUPONT BEAUMONT PLANT	25%	2,767,192	220,541,998,603	4,666,945,170	220,549,721,72
06383FDRLPINLAN	FUSION PAPERBOARD - CONNECTICUT	34%	280,562	195,407,735,200	295,250	195,408,030,45
77571LPRTC2400M	OXY VINYL/LP LA PORTE VCM PLANT	25%	4,254,377	185,192,540,946	231,001,382	185,403,833,29
77541HNTSM307CO	HUNTSMAN ETHYLENEAMINES PLANT	25%	5,689,737	175,018,476,588	198,867,652	175,019,893,43
32831STNTN5100S	STANTON ENERGY CENTER	18%	890,751	167,293,940,000	4,449,448,715	169,854,815,72
42348CNTRY1627S	CENTURY ALUMINUM OF KENTUCKY	3%	1,264,670	160,681,000,000	298,583,000	160,772,802,70
7515WTRMPH3AUST	TRIUMPH AEROSTRUCTURES RED OAK	25%	28,369	160,478,531,875	130,622,521	160,478,666,27
29602MCPRFPOBOX	CYTEC CARBON FIBERS LLC	34%	641,218	146,405,564,600	1,117,767,325	146,425,939,72
3651WTHYSS1THYS	OUTOKUMPU STAINLESS USA LLC	34%	3,658,655	143,866,600,000	291,598,624	143,913,064,43
83276MNSNTHIGHW	P4 PRODUCTION LLC	25%	275,719	140,601,073,400	3,378,105,890	141,173,991,04

Records: 1 of 16694

Export to Excel

Export to Text

Figure 34: 2014 Risk Screening Environmental Indicators Overall RSEI Hazard Index for Radford Army Ammunition Plant, BAE Systems at #4 in the United States, and Alliant Techsystems New River Energetics at #3 in the United States for overall RSEI Hazard<sup>529</sup>

529 Ibid.





Source: Virginia Department of Health, Lead-Safe Virginia Program

Figure 35 Elevated Blood Lead Levels in Children 0-15 Years for New River Health District Localities Compared to Virginia<sup>530</sup>

RFAAP has had two incidents in the last 3 years. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

The second incident occurred in October 2012 and involved a [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

*Figure 36: Redactions in the 2014 EPA's National Enforcement Investigations Center Follow-Up Inspection Report of Radford Arsenal<sup>531</sup>*

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531 Bustamante.

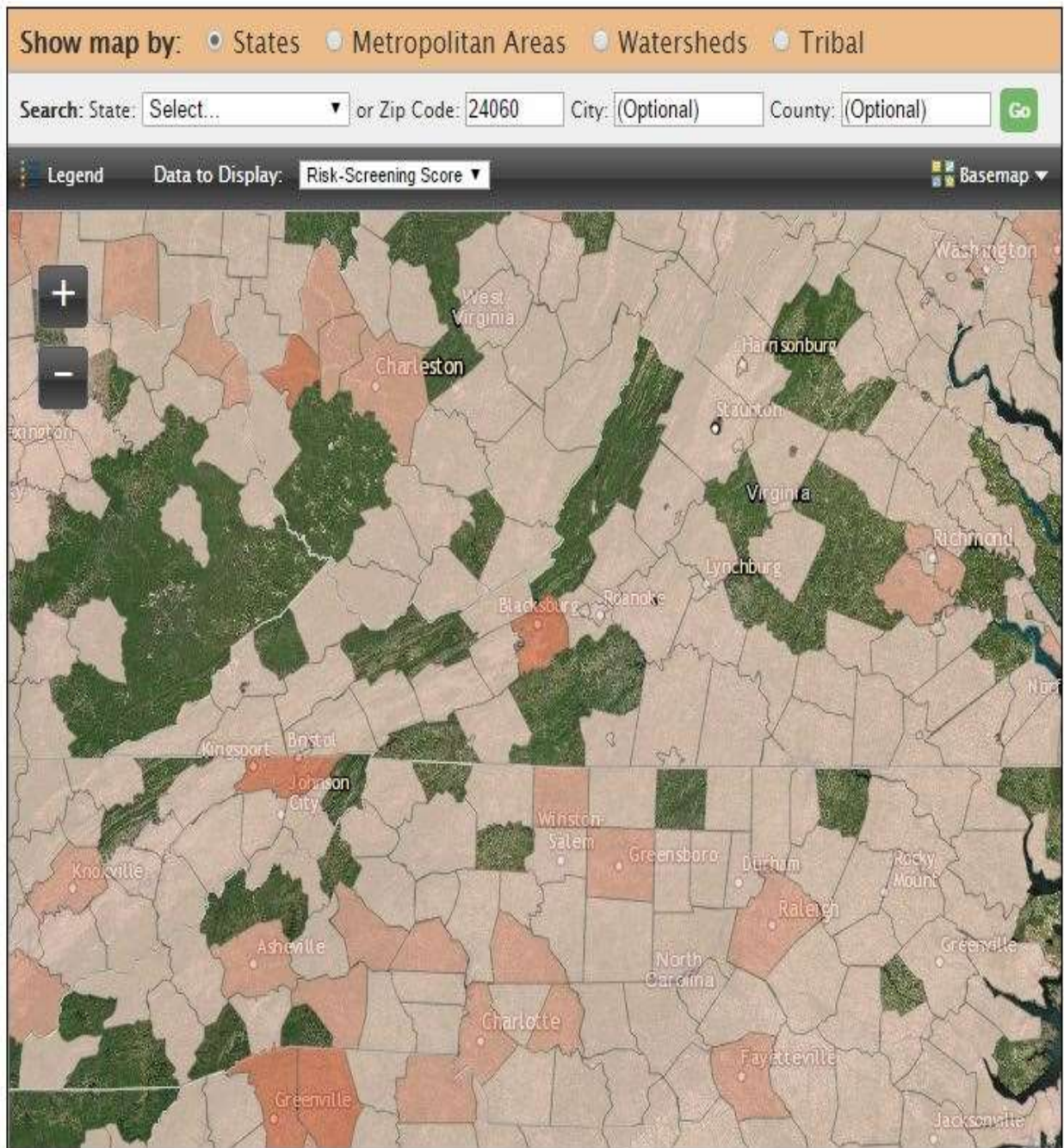


Figure 37: TRI Map Showing Juxtaposing Risk in Montgomery County with Other Counties in the Region<sup>532</sup>

532 United States Environmental Protection Agency, "Toxics Release Inventory Program".

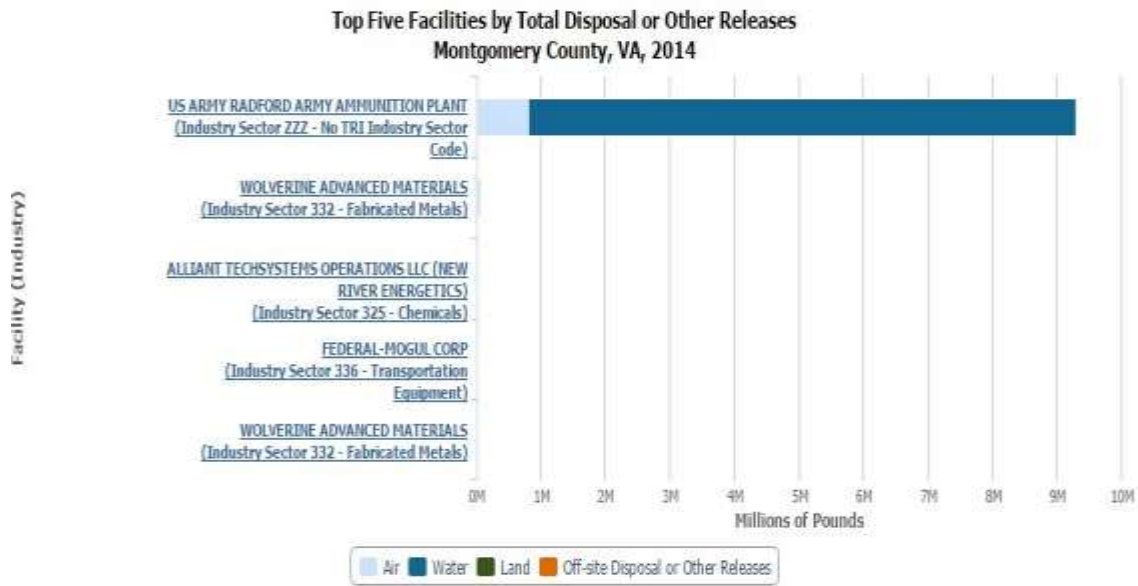


Figure 38: Top Five Facilities for Releases in Montgomery County Virginia<sup>533</sup>

533 Ibid.

## TRI Facilities with name(s) "Radford" (2014)

Search Criteria Used (More)	
Reporting Year	2014 <input type="button" value="GO"/>
Level of Detail	Summary <input type="button" value="GO"/>
Type of Report Output	Text (HTML) <input type="button" value="GO"/>

### Comparison of all of facility US ARMY RADFORD ARMY AMMUNITION PLANT, 2014 with other TRI facilities?

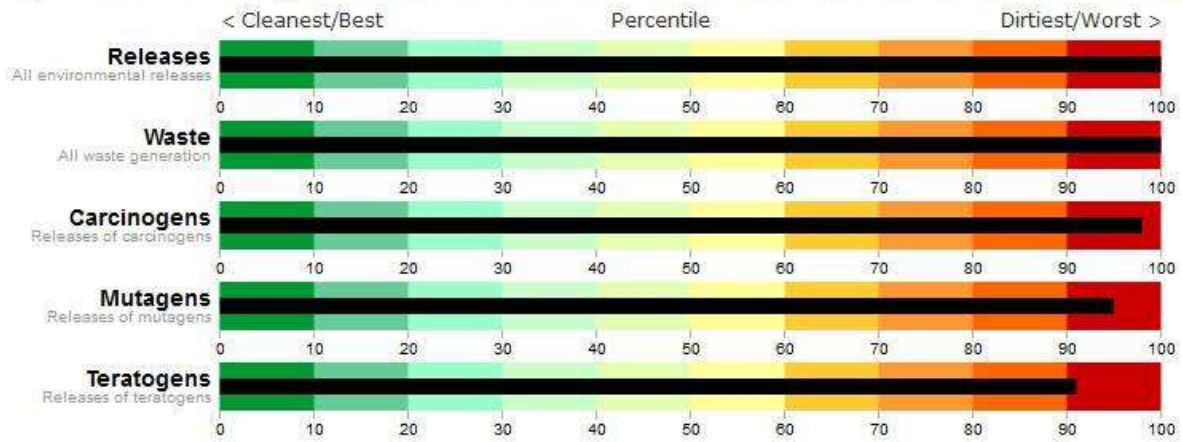
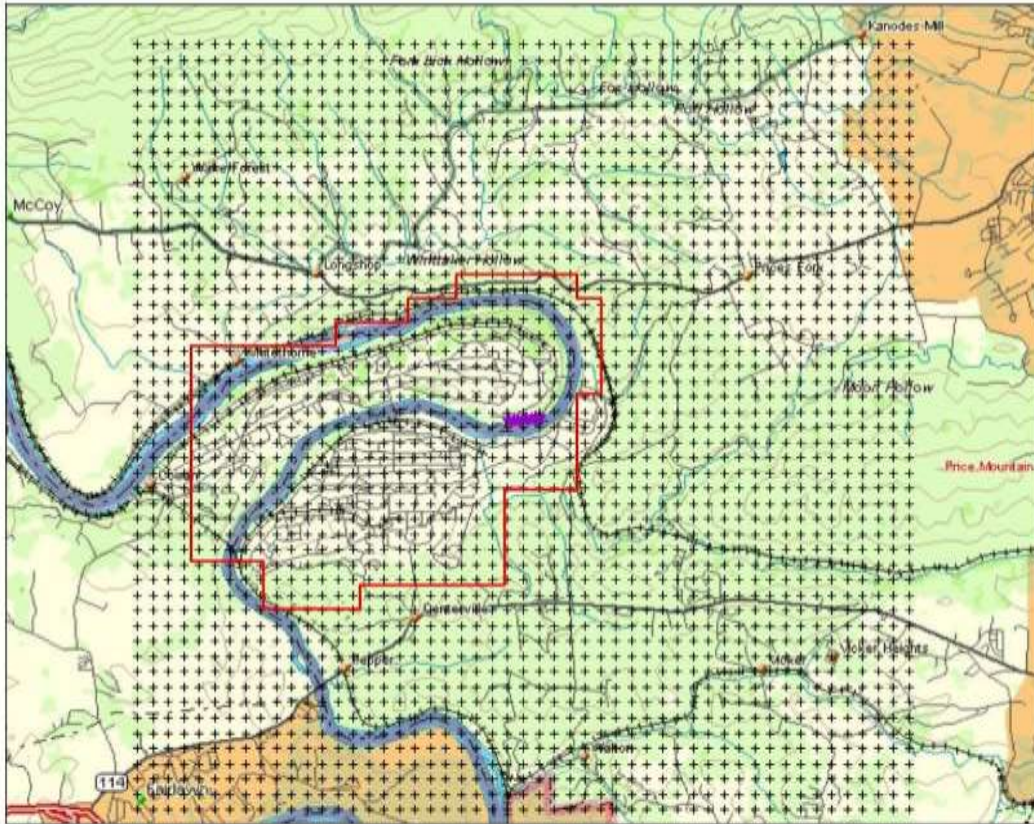


Figure 39: Toxic Release Inventory Graph, Right to Know Network, for BAE Component at RAAP Compared to Other Facilities in the Nation in 2014<sup>534</sup>

534 "Toxic Releases (Tri) Database | Rtknet.Org: The Right-to-Know Network," <http://www.rtknet.org/db/tri>.



Scale in meters  
 0 1000 2000

LEGEND  
 ★ Burn Pan Location  
 + Coarse grid receptor  
 — Site Property Line

**Figure 3-3**  
**Receptor Grid and Facility Fence Line**  
 Human Health Risk Assessment  
 Radford Army Ammunition Plant, Radford, VA

Figure 40: Receptor Grid for Fenceline Exposure Grid Modeling Square Dispersion from Open Burning at Radford Arsenal<sup>535</sup>

535 CH2MHILL, "Human Health Risk Assessment for the Open Burning Ground, Radford Army Ammunition Plant."

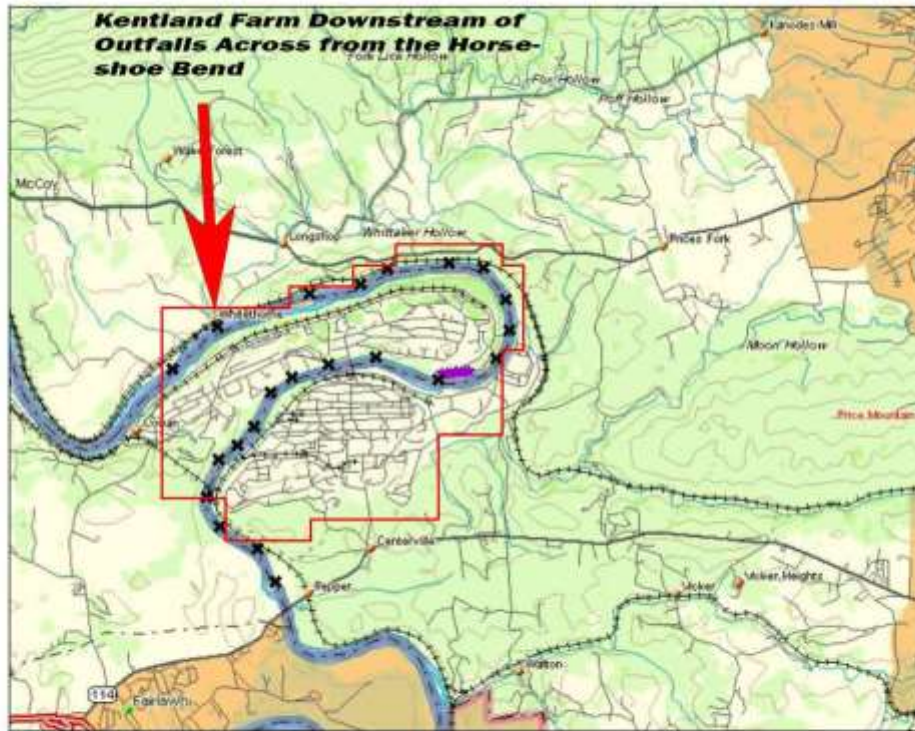
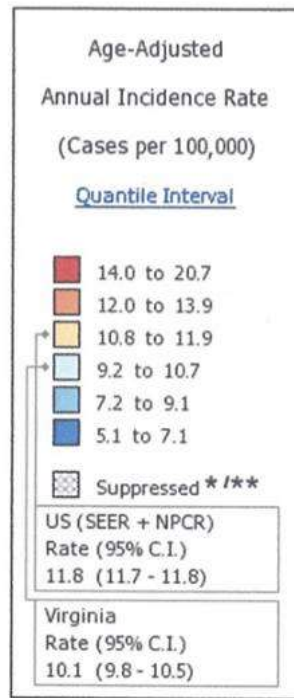
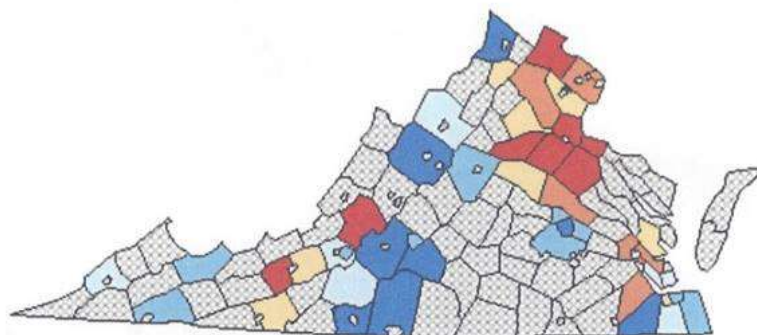


Figure 41: Map of Outfalls at RAAP Showing Proximity to Kentland Farm<sup>536</sup>

**Incidence Rates<sup>†</sup> for Virginia, 2005 - 2009**  
**Thyroid**  
**All Races (includes Hispanic), Both Sexes, All Ages**



Created by statecancerprofiles.cancer.gov on 06/18/2012 9:29 pm.  
 State Cancer Registries may provide more current or more local data.  
 Data presented on the State Cancer Profiles Web Site may differ from statistics reported by the State Cancer Registries (for more information).

<sup>†</sup> Incidence rates (cases per 100,000 population per year) are age-adjusted to the 2000 US standard population (19 age groups: <1, 1-4, 5-9, ... , 80-84, 85+). Rates are for invasive cancer only (except for bladder which is invasive and in situ) or unless otherwise specified. Rates calculated using SEER\*Stat. Population counts for denominators are based on Census populations as modified by NCI. The US populations included with the data release have been adjusted for the population shifts due to hurricanes Katrina and Rita for 62 counties and parishes in Alabama, Mississippi, Louisiana, and Texas. The 1969-2009 US Population Data File is used with SEER November 2011 data. The 1969-2009 US Population Data File is used with NPCR January 2012 data.

\* Data have been suppressed to ensure confidentiality and stability of rate estimates. Counts are suppressed if fewer than 16 cases were reported in a specific area-sex-race category.

\*\* Data have been suppressed for states with a population below 50,000 per sex for American Indian/Alaska Native or Asian/Pacific Islanders because of concerns regarding the relatively small size of these populations in some states.

Figure 42: Unavailable 2005-2009 Thyroid Cancer Incidence Map<sup>537</sup>

537 National Cancer Institute, "State Cancer Profiles," Center for Disease Control, <https://statecancerprofiles.cancer.gov/map/map.noimage.php>.



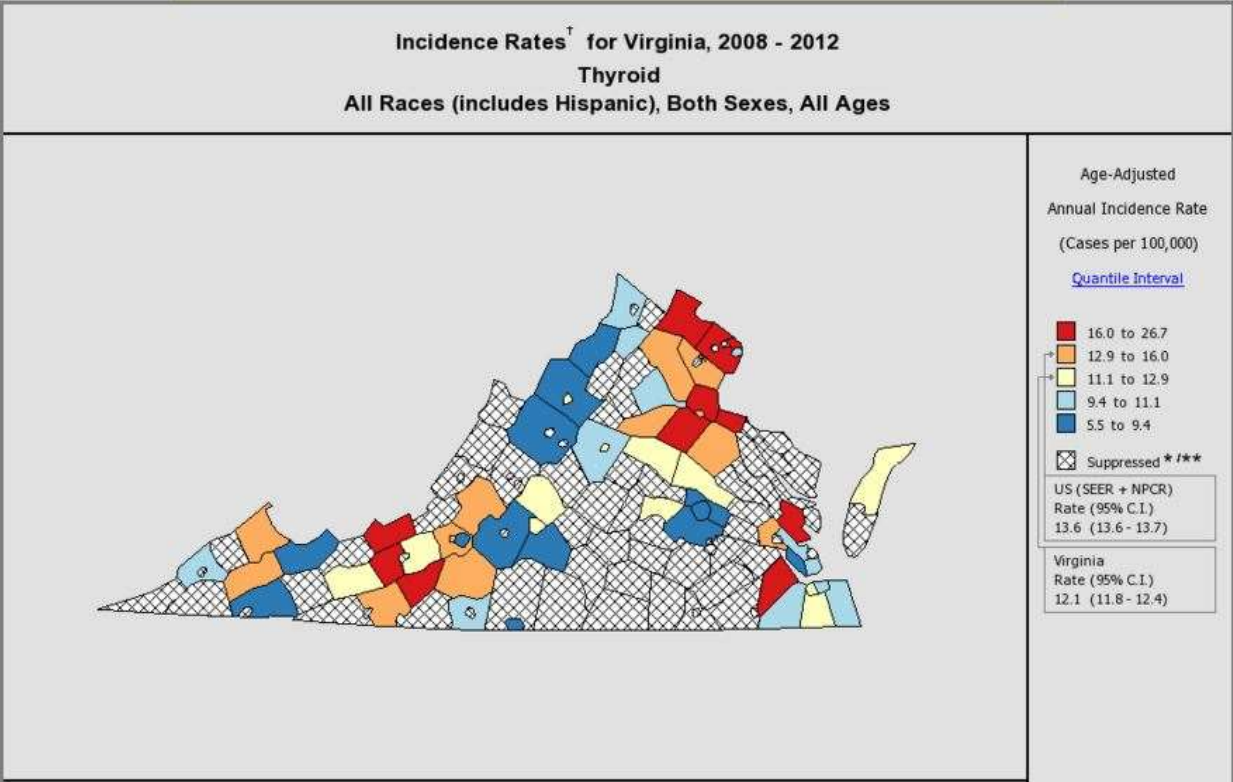


Figure 43: Unavailable 2008-2012 Thyroid Cancer Incidence Map<sup>538</sup>

538 Ibid.





<http://www.epa.gov/osw/hazard/correctiveaction/success/r3radford.htm>

Last updated on 08/28/2008

## Wastes - Hazardous Waste - Corrective Action

You are here: [EPA Home](#) [Wastes](#) [Hazardous Waste](#) [Corrective Action](#) [Success Stories](#)  
Region 3/Radford Cleanup Success Story

### Region 3 Develops a Unique Corrective Action Permit for the Radford Army Ammunition Plant in Virginia

Radford Army Ammunition Plant (Radford AAP) is a government owned/contractor operated (GO/CO) industrial complex located in Radford, Virginia. Construction of the production facilities began in 1940 with the impending participation of the United States in World War II and the need for increased ammunition production facilities. Since the need for ammunition production has decreased, the Army is trying to diversify the operating capabilities of the facility. Radford AAP is a RCRA permitted facility which is subject to Corrective Action and, due to the magnitude and extensive operating history, maintains areas potentially subject to cleanup via the Superfund program. While clean-up of Federal Facilities is typically done under CERCLA authority, in this particular instance, there were concerns that an NPL listing would decrease the economic development potential for this GO/CO facility.

Recognizing this problem, EPA Region III worked cooperatively with facility representatives and the Virginia Department of Environmental Quality and developed a unique RCRA Corrective Action Permit that addressed both RCRA and CERCLA concerns yet allowed economic development to continue at the site. In an effort to reduce duplication of effort and investigation costs, the Permit contains provisions which closely parallel those typically found in Federal Facilities Agreements negotiated in the CERCLA program. In addition, remediation of the site will be integrated under the direction of one Project Manager in the Region's Superfund program. The economic development of underutilized Army plants is paying off, under the Armaments Retooling and Manufacturing Support ( ARMS ) Initiative. At Radford, 19 commercial tenant activities have located or relocated/expanded there. These businesses include commercial powders, pyrotechniques, metalworking, wholesalers of pipe, valves & fittings, hardware, tools and fasteners, a wellness center, and office activities. A total of 360 tenant jobs have been created, of which over 300 are manufacturing. This philosophy of diversification has brought new jobs to the surrounding community. The estimated economic impact of each new good manufacturing job is 1-3 indirect support jobs for the community. Radford AAP is owned by the U.S. Department of the Army and is operated by Alliant Ammunition and Powder Company LLC under a facility use agreement and contains approximately 1969 buildings and occupies over 6900 acres. The facility is located in Pulaski and Montgomery counties approximately 10 miles west of Blacksburg and 47 southwest of Roanoke. Radford AAP manufactures solid propellants used in small arms (sporting and military), anti-aircraft, tanks, artillery, and small rockets. Radford AAP also Loads, Assembles, and Packs medium caliber ammunition and mortar cases.

Figure 45: EPA Region Three Develops Unique RCRA Corrective Action Permit for RAAP with Misinformation from Distance from Blacksburg<sup>540</sup>

540 Environmental Protection Agency: Region 3, "Region 3 Develops a Unique Corrective Action Permit for the Radford Army Ammunition Plant in Virginia," (2011).

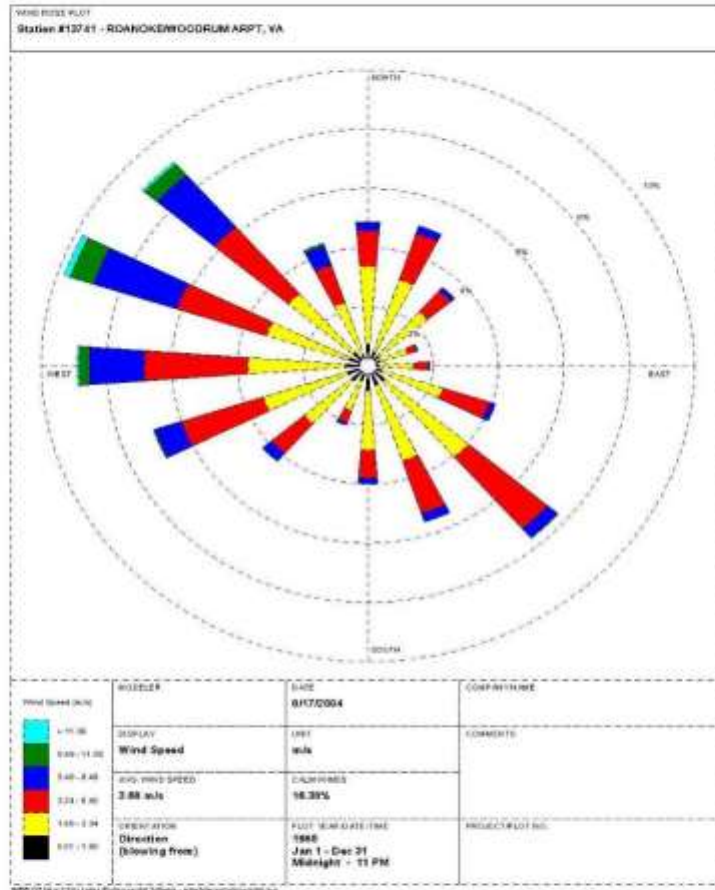
Table 4-1  
Performance Standards Based on Human Health and Ecological Risks  
Radford Army Ammunition Plant, Radford, Virginia

Type of Risk	Type of Burn Scenario	Exposure Scenario	Risk Driver (Constituent)	Applicable Waste Groups	Limit (lb/day)	Notes
Human Health Risk	Propellant Burn	Residential		All	8,000	
		Subsistence Fisher		All	8,000	
		Subsistence Farmer	Dioxins	Groups 11 and 18 with total chloride > 1%	2,800	Groups 11 and 18 waste stream will be tested for total chloride, limit will be 8,000 lb/day for lots with total chloride < 1%
	Skid Burn	Residential		All	2,000	
		Subsistence Fisher		All	2,000	
		Subsistence Farmer	Dioxins	Group 20 with total chloride > 1%	see note	Group 20 waste stream will be tested for total chloride limit will be 2,000 lb/day for lots with total chloride < 1%. RAAP will develop a testing program for the waste stream to evaluate total chloride content in batches prior to burning. Chloride contents will be adjusted to achieve a 1% limit for total chloride prior to burning. RAAP will survey potential impact area to verify that land uses corresponding to this exposure scenario are not present.
	Skid Burn (mitigated)	Residential		All	2,000	
		Subsistence Fisher		All	2,000	
		Subsistence Farmer		All	2,000	RAAP will survey potential impact area to verify that land uses corresponding to this exposure scenario are not present.
	Ecological Risk	Propellant Burn	Terrestrial			8,000
Aquatic (surface water)			Lead	Groups 7 and 12 waste streams with lead > 870 ppm	3,400	Groups 7 and 12 waste stream will be tested for total lead, limit will be 8,000 lb/day for lots with total lead < 870 ppm
Skid Burn		Terrestrial (bursa)	Chromium	Group 20 with > 7 ppm chromium	1,100	Group 20 waste stream will be tested for chromium. Limit will be 2,000 lb/day for lots with chromium < 7 ppm. Waste feeds will be adjusted to achieve a 7 ppm limit for chromium prior to burning.
		Terrestrial (foodweb)	Dioxins	Group 20 with total chloride > 1%	see note	Group 20 waste stream will be tested for total chloride. Limit will be 2,000 lb/day for lots with total chloride < 1%. Waste feeds will be adjusted to achieve a 1% limit for total chloride prior to burning.
			Lead	Group 20 with lead > 520 ppm	500	Group 20 waste stream will be tested for lead. Limit will be 2,000 lb/day for lots with lead < 520 ppm. Waste feeds will be adjusted to achieve a 520 ppm limit for lead prior to burning.
		Aquatic		All	2,000	
Skid Burn (mitigated)		Terrestrial (foodweb)	Lead	Group 20 with lead > 520 ppm	500	Group 20 waste stream will be tested for lead. Limit will be 2,000 lb/day for lots with lead < 520 ppm. Waste feeds will be adjusted to achieve a 520 ppm limit for lead prior to burning.
		Aquatic (surface water)		All	2,000	

**Notes**  
 Subsistence farmer scenario is a land use unlikely to be present within the study area. Value is provided only for comparison purposes.  
 The Skid Burn (mitigated) scenario involves a burn pan that uses a supply of propane or natural gas as the donor fuel and a remotely actuated spark ignitor as the ignition source. With this approach, the donor fuel is delivered and combusted as needed and higher combustion temperatures are maintained throughout the burn.  
 Total chloride limit is based on studies indicating that 1% total chloride is a threshold for forming excess dioxins and furans during combustion (U.S. EPA, 2003).  
 At no time will the Risk Drivers (Constituents) exceed the composition % set forth in Table 2 of Appendix B-1.

Figure 46: 2013 OBG Permit Stating Subsistence Farmer Unlikely Land Use in the Study Area despite Construction of Kentland Farm Dining Services Facility<sup>541</sup>

541 Leslie Romanchik, "Final Permit for the Treatment of Hazardous Waste by Open Burning," ed. Virginia Department of Environmental Quality (2013).



**Figure 3-9**  
Wind Rose  
Human Health Risk Assessment, Open Burning Ground  
Radford Army Ammunition Plant, Radford, Virginia

Figure 47: Wind rose Model from 2005 Open Burning Ground Human Health Risk Assessment Using Wind Models from Roanoke Airport over 30 Miles Away from the Open Burning Ground



*Figure 48: Picture Taken on 5-24-16 of Plume Moving Behind Price's Fork Elementary School Toward Belview Elementary School*



*Figure 49: The Scholar-Activist Protesting Open Burning in Front US Congressman's Office on 4/20/16*



*Figure 50: The Destruction of the Dairy Complex Facilities on the Central Campus of Virginia Tech in spring of 2016 after the Relocation of the Facilities Across from Radford Arsenal in 2015*



Action Memo Photos  
Explo Systems, Camp Minden, LA



Photo 1: M6 Propellant improperly stored outside by Explo



Photo 2: M6 Propellant scattered on the ground (after October 2012 explosion)



Photo 3: Result of explosion of magazine storing black powder and tractor trailers storing M6 Propellant in October 2012



Figure 51: Action Memo Photos of Explosion of Explosive Magazine and Improperly Stored Propellant<sup>542</sup>

542 United States Environmental Protection Agency Region 6, "Action Memo Photos: Explo Systems, Camp Minden, LA," ed. US EPA (2012).

Action Memo Photos  
Explo Systems, Camp Minden, LA



Photo 4: Example of explosive storage magazine at Camp Minden



Photo 5: Trees growing on top of explosive storage magazine at Camp Minden



Photo 6: M6 propellant and Aluminum/TNT/Tritonal stored in explosive storage magazine at Camp Minden



Photo 6: Nitrocellulose stored in explosive storage magazine at Camp Minden

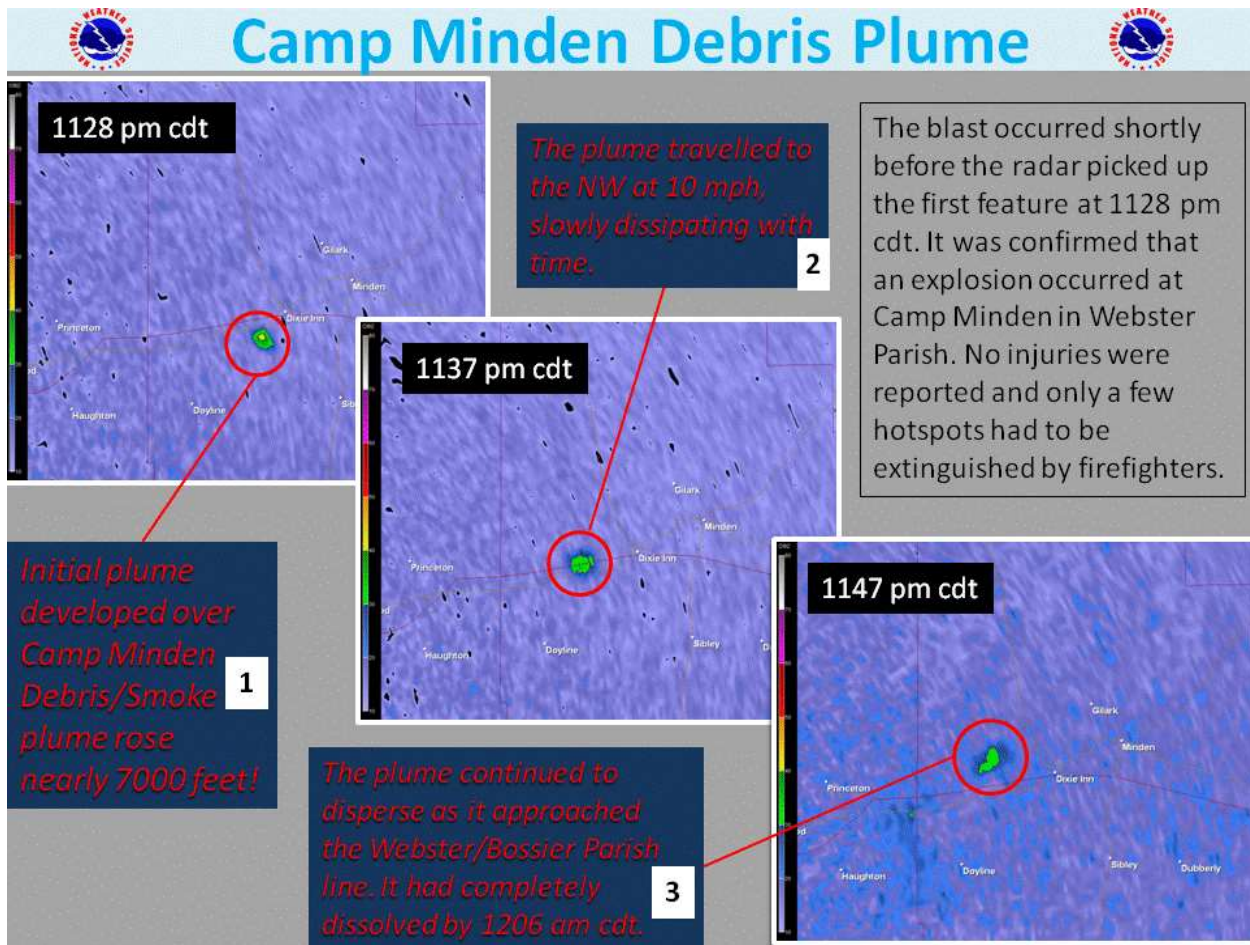


Figure 53: National Weather Service Showing Plume from Minden Explosion<sup>544</sup>

544 NOAA US Department of Commerce, National Weather Service and National Weather Service, "Webster Parish Explosion Caused by Explosion of Old Munitions at Camp Minden Last Night," NOAA's National Weather Service, <http://www.srh.noaa.gov/shv/?n=webster-parish>.



*Figure 54: Lifting the World's Largest Contained Burn Structure into Place<sup>545</sup>*

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545 "Updated Photos: Louisiana National Guard," <http://ec2-52-2-192-248.compute-1.amazonaws.com/camp-minden-m6/updated-photos/>.



*Figure 55: The World's Largest Contained Burn Chamber in Place<sup>546</sup>*

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546 Ibid.



*Figure 56: The Contained Burn Structure with the Pollution Abatement System<sup>547</sup>*

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547 Ibid.



**PAS System Construction**

*Figure 57: The Pollution Abatement System, Making this The World's Most Advanced Contained Burn System<sup>548</sup>*

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548 Ibid.

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