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DISPOSING OF RACIAL INJUSTICE

An Impact Analysis of Kettleman City's Hazardous Waste Facility

By Shruti Patrachari

This paper will identify current health concerns inflicting Kettleman City and its corollary between race and hazardous waste, a comparison that has shown to disproportionately affect low-income communities of color. California reigns as the state with the nation's highest concentration of minorities living near hazardous waste facilities, a correlation that generates concern in the public over racial targeting, particularly in Kettleman City, home of the largest hazardous waste plant west of the Mississippi. Kettleman City has been under scrutiny for hazardous waste violations, sparking conversations amidst the public regarding birth defects, infant mortality, increased cancer risk, and environmental racism, as the community comprises of primarily low-income farming families. Residents have actively mobilized since the 1990s, accompanying the establishment of the Kettleman Hill Hazardous Waste landfill within three miles of the City's residential district, and have meaningfully publicized increased occurrence of cleft palate and infant mortality. Through implementation of quantitative analysis, this paper will provide an overview on the intersectionality between waste, race, and class, addressing alleged health effects, as well as identifying sociopolitical impacts affecting frontline communities of hazardous waste operations.

I. Overview

The Environmental Protection Agency (EPA) first classified hazardous waste in 1976 as a means to identify and subsequently treat the increasing volumes of industrial and hazardous waste—promoting the establishment of Treatment Waste Disposal Facilities (TWDF), commonly known as hazardous waste facilities, soon after in 1981. In spite of protections to responsibly manage hazardous waste, unforeseen effects allegedly associated to hazardous waste still arose amid public controversy regarding increased public health risks. Researchers have examined such alleged risks, and have identified birth defects and developmental anomalies associated with residing in close proximity to hazardous waste facility. Resulting from the disproportionate populations of people of color both affected by and located near hazardous waste facilities relative to their racial counterparts, researchers postulate potential cases of environmental injustice in facility siting.

In California, 50% of hazardous waste facilities are concentrated among highly populated industrial neighborhoods, with over 81% of people of color residing within one mile radius of a hazardous waste facility. Today, Kettleman City is home to the largest hazardous waste facility west of the Mississippi, with approximately

10.7 cubic yards of hazardous waste across a 1,600 acres sized landfill, operated by Chemical Waste Incorporated, a subsidiary of its parent company Waste Management Incorporated.¹ In November 2012, the State of California cited seventy-two violations affirming Waste Management Incorporation's failures to meet regulation, including improper equipment use and waste spillage, triggering debate over environmental racism and the disproportionate burden of impact. Alleged violations sparked controversy with the public, which was unsuccessful in preventing the landfill's five million cubic yard expansion in 2014; they managed to, however, publicize civil rights issues and health concerns.² Public health risks in Kettleman City have arisen resulting from hazardous waste precipitating into the groundwater, as well as pollution from hazardous waste treatment exposing nearby communities to chemical toxins.

This paper will analyze the health effects from the Kettleman hazardous waste facility and its predicted disproportionate risks on low-income communities of color. Through an analysis of the intersection between health and race, this paper will identify contemporary trends regarding the concentration of hazardous waste facilities and the demographics of surrounding communities.

This paper assumes health as a human right, as defined by the Office of the United Nations High Commissioner for Human Rights and the World Health Organization. Endangerment of one's health constitutes a violation of this right, and thus can be defined as an injustice.³ For the purpose of argument, the term justice is used in accordance with the California Environmental Protection Agency Environmental Justice Action Plan, based off the broader Civil Rights Act of 1964, outlawing discriminatory practices with regard to "race, national origin, or income".⁴ Expanding from this definition of justice, we can then take racism, as the term is used in this analysis, to refer to a failure to meet these guidelines for justice, narrowing our observation to the guiding variable of race. The specific realm within which this paper looks at race and its general relation to justice is environmentalism and public health—closely looking into the health implications from environmental implications wrought by hazardous waste facilities.

II. Introduction

Kettleman City, located in the heart of California's Central Valley, is a region located off the Interstate 5 experiencing pollution from agriculture, exposure to vehicle congestion, and hazardous waste. Kettleman City has a small population of 1,439 of primarily foreign-born rural farm workers, and ranks in the 95th percentile of most affected communities from health and environmental concerns, including birth defects, infant mortality, increased risk of cancers, and groundwater leachate.⁵ In the 2000 Census, the median household income was twenty thousand four hundred and nine USD with 43.9% of the population living below the national poverty threshold.⁶ The city is an unincorporated area, lacking formal political representation in the local county government for regional decision making, requiring intervention from county planning commission and elected Board of Supervisors for zoning and land-use management. Kings County, the county encompassing the Central Valley City, consists of eleven cities whose demography reflects a predominantly white population (over 50%) in all but one city: Kettleman City.⁷ Construction and operation of a hazardous waste facility in the sole locality in the county with a majority population of people of color raised speculation among the public, which was left unnotified about its development despite the facility's location within a three mile radius of the town.

Kettleman City originated as a ranching community in the 1850s, supported by oil extraction that grew the economy in the wake of the industrial revolution. Upon decline of oil production in the 1950s, agriculture became

1 Wozniacka, G. (2013, July 2). California recommends expansion of hazardous dump.

2 Nicks, D. (2014, May 21). California Approves Expansion of Toxic Dump.

3 World Health Organization, and Office of the United Nations High Commissioner for Human Rights. "The Right to Health." Office of the United Nations High Commissioner for Human Rights. 2008.

4 California Department of Toxic Substances Control. "Environmental Justice Review -- The Kettleman Hills Facility." June 2013.

5 California Environmental Protection Agency, Office of the Secretary, & Environmental Justice Program. (2004, February). California Environmental Protection Agency Environmental Justice Program Update.

6 United States Census Bureau. "2011-2015 American Community Survey 5-Year Estimates - Kettleman City CDP, California." American FactFinder. 2014.

7 United States Census Bureau. "2011-2015 American Community Survey."

the primary “economic force,” necessitating the construction of the California aqueduct and infrastructure for agricultural production in the arid region south of the San Joaquin Valley.⁸ As the economy shifted, transitions in demography followed, with Kettleman City’s population reflecting 96% Latinos, 40% of whom were monolingual Spanish, or indigenous language speakers.⁹

In 1979, Waste Management, Inc., the world’s largest waste disposal company, purchased land in Kettleman City, with permits to process polychlorinated biphenyls (PCBs) and Class I waste, or hazardous material.¹⁰ Without formal notification to residents, the company established the Kettleman Hills hazardous waste facility a mere three miles west from the town along Highway 41.¹¹ Following the establishment of the facility, advocates argued that the impetus behind Waste Management, Inc.’s actions in Kettleman City was related to environmental racism—referencing the city’s 96.1% Latino population.¹² As of 2015, Waste Management has not been an important employer in Kettleman City, as it employed 30 individuals, amounting to 2.1% of the town’s population. Reports have since characterized Kettleman City as a cluster of birth and infant deaths, pointing to the hazardous waste landfill as a potential originator for these trends.¹³

One year following the establishment of the hazardous waste landfill, Waste Management, Inc. proposed construction of an incinerator: a project later shut down by consistent public organizing. Previously, the landfill had been cited by the Toxic Substances Control Act (TSCA) committee for various misdemeanor related to noncompliance of monitoring and unpermitted disposal of liquid hazardous waste.¹⁴ From 2002-2003, the EPA reported sixteen spills of hazardous waste materials and six cases of waste stores in unsealed containers in Kettleman City, drawing community turnout at public hearings in protest.¹⁵

Greenaction for Health and Environmental Justice (Greenaction), a grassroots organization working towards justice for low-income and working class individuals, filed a statement in 2009 condemning Waste Management, Inc. for its violations, alleging that its operations are correlated with the increasing birth defects, involving fourteen cases related to cleft lip, infant mortality, and developmental defects. In the same statement, Greenaction stated that the Kettleman City waste site was one of twenty-two other facilities that the EPA had cited for “unusually high levels of radiation.”¹⁶ Greenaction opened a lawsuit against Waste Management, Inc. for negligence in noncompliance with the California Environmental Quality Act to halt facility operations; however, the lawsuit was overlooked as Waste Management sought permits for expansion.¹⁷ The effect of the expansion has been predicted to increase to 4.6 billion pounds of toxic waste to the site, 50% of its current capacity, generating concerns around environmental injustice and increased public risks, for Waste Management Inc. has been fined for over seventy spills.¹⁸

The Resource Conservation and Recovery Act (RCRA) of 1976 was first established to promote human and environmental health from degradation and toxicity associated with hazardous waste disposal; however, the town’s three decade long exposure to hazardous waste calls into question whether the Act maintains its intended purpose. The Kettleman Hills Hazardous Waste Facility is subject to the RCRA, requiring permits for expansion and disposal under supervision of the local government over land use decisions, and the state government over

8 Cullen, Alison, & Drummond, Kate. “Debating Risk and Environmental Justice in Kettleman City: Conflict in the Siting of a Hazardous Waste Incinerator.” 2006.

9 Cole, L. W., & Foster, S. R. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. New York: New York University Press.

10 California Department of Toxic Substances Control. “Kettleman Hills Facility Permitting Activities.” 2010. Accessed August 28, 2017.

11 Pérez, A. C. (2015, August 07). Toxic Waste Landfill in Kettleman City, USA | EJAtlas.

12 Cole, L. W., & Foster, S. R. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. New York: New York University Press.

13 Pérez, A. C. (2015, August 07). Toxic Waste Landfill in Kettleman City, USA | EJAtlas.

14 CWM Kettleman Hills Facility Inspection Enforcement History. 2015. Waste Management, Inc.

15 Environmental Protection Agency. (2004). *Inspection Report: Kettleman Hills Facility*.

16 Sahagun, L. (2009, December 08). Kettleman City asks: Why so many birth defects? Some residents of the impoverished town wonder if a nearby hazardous waste facility is to blame. Greenaction.

17 *El Pueblo Para El Aire et al, v. Kings County Bd. of Supervisors CA5, No. 10C0017* (Court of Appeal of the State of California July 03, 2012).

18 Alejo, L. (2013, October 10). Assemblyman Alejo Opposes Expanding Toxic Waste Disposal in Kettleman Hills.

health and safety management.¹⁹ The process continues with federal government oversight by the EPA, the official granting agency of the permits, contingent upon State authorization. With the intention of granting limited power to the public, California enacted the Tanner Act, a law specific to the state requiring local governments to appoint a Local Assessment Committee (LAC) to be spokespeople for the community and advisors to local government for granting permits.²⁰ While providing local representation, the Tanner Act also allowed local government to tax Waste Management, Inc. up to 10% of their revenue and reinvest it into Kings County general fund, making up 0.05% of the county's budget.²¹

Garnering public support, grassroots movements rose in an effort to defeat the expansion of the landfill—identifying the Kettleman Hills hazardous waste facility as an environmental burden. With the communities weak legal infrastructure, and large population of people of color, coalitions organized around the greater burden of health risks borne onto the Kettleman City public. El Pueblo Para El Aire y Agua Limpio (The People for Clean Air and Water), Greenaction, and the Center for Race, Poverty and the Environment submitted two appeals to the Department of Toxic Substances Control (DTSC) challenging the issuance of the permit on the basis of civil rights; however, were both denied in 2014. Approved permits allowed the continuance of the Kettleman City hazardous waste facility expansion, allowing Chemical Management, a Waste Management corporate subsidiary, to expand the landfill to accommodate an additional 5.2 metric tons of capacity under compliance of the Resource Conservation and Recovery Act.²² Over time, this hazard has remained persistent and unmoving exposing individuals in the region to constant contamination.

In August 2016, Greenaction and El Pueblo Para el Aire y Agua Limpia in Kettleman City reached an agreement with the DTSC and California Environmental Protection Agency (CalEPA) resolving the organization's 2013 civil rights complaint over the permitted expansion of the Kettleman Hill hazardous waste facility. The agreement binds state agencies and communities to Title VI of the Civil Right Act, prohibiting discrimination on the basis of race, color, or national origin. To improve public health and environmental quality in Kettleman City, DTSC made an agreement with community groups to conduct health assessments, increase monitoring, and implement asthma intervention programs to reduce vulnerabilities possibly caused from hazardous waste exposure. Bound under the Civil Rights Act, the DTSC may face legal ramifications upon nonadherence, violating environmental regulations and reducing the likelihood of renewing the operating permit of Waste Management's hazardous waste landfill. Ensuring the agreement is met, the State department adopted policies to incorporate meaningful public participation, translating text document in Spanish to accommodate the large population of monolingual Spanish speakers.²³ This enables more community participation at the political level, access to which was previously restricted to English-speakers, and is a step towards equal treatment and political voice.

III. Major Questions

1. What are health implications of common toxins released from hazardous waste facilities?
2. Is the health of communities in close proximity to hazardous waste facilities at greater risk relative to those outside district lines?
3. Has the presence of hazardous waste facilities in communities caused a transition in population, such that there are disproportionately high concentrations of low-income minority residents?

IV. Findings

19 EPA's Office of Resource Conservation and Recovery, and U.S. EPA's Community Engagement Initiative Action 3 Working Group. "Compendium of Key Community Engagement Practices at RCRA Sites." Environmental Protection Agency. January 4, 2013.

20 EPA's Office of Resource Conservation and Recovery, and U.S. EPA's Community Engagement Initiative Action 3 Working Group. "Compendium of Key Community Engagement Practices at RCRA Sites." Environmental Protection Agency. January 4, 2013.

21 County of Kings, Final Budget. (2015-2016). Final Budget. Volume I Program Budgets, Fiscal Year ending June 30, 2016.

22 Wozniacka, G. (2013, July 2). California recommends expansion of hazardous dump.

23 Greenaction for Health and Environmental Justice, El Pueblo Para el Aire y Agua Limpia de Kettleman City. (2016, August 10). Landmark Agreement Reached to Benefit Environmental Justice Communities and Resolve a Title VI Civil Rights Complaint on Hazardous Waste Permitting Decision [Press release]. Greenaction.

A. What are health implications that allegedly affect communities located in close proximity to the Kettleman City hazardous waste facilities?

i. Groundwater Contamination

Kettleman City's water system supplies two water systems: the Kettleman City Community Services District (CSD), available to all residents, and the Kettleman City Elementary School water system, serviced specifically to the elementary school. Upon analyzing the water, the EPA detected that benzene in untreated water at the municipal well had concentrations surpassing the one $\mu\text{g/L}$ drinking water standard.²⁴ Additionally, arsenic was found in the well at sixteen parts per billion (ppb), higher than the state drinking water standard of ten ppb.²⁵ In an analysis on chemical toxicity, arsenic was found to damage respiratory, endocrine, and nervous system health.²⁶

The Kettleman City landfill employs a lined multi-layer system comprising of geomembrane, clay, and drainage layers impermeable to hazardous waste materials to prevent leachate, water contaminated with chemicals. In 1988, the Kettleman Hills Hazardous Waste Facility endured a failure in slope-stability, resulting in tears in the multi-layer barrier protecting precipitation of hazardous waste into the surrounding environment. With the lining preventing leakage now damaged, researchers found an almost 20% increase in metalloids in the groundwater supply compared to prior levels. However, the lining lacked a failsafe displacing the surface of the waste to thirty-five feet, enabling percolation of hazardous waste inundating the fill to fourteen feet.²⁷ Figure nine exemplifies the noticeable effects from the failure of the barrier to withstand pressure in comparison to its conditions prior. As hazardous waste material percolated through the groundwater, it posed public health threats to the surrounding communities from rising toxins in the water.

ii. Chromium-6 Exposure

Hazardous waste percolation into the groundwater has led the CalEPA to theorize about the cause of the identified levels of chromium-6 by the CalEPA. Residents attribute increasing levels of chromium-6 to the presence of industrial facilities in Kettleman City attributed to potential dumping of contaminated wastewater into groundwater systems.²⁸ The International Agency for Research on Cancer and the US EPA identify chromium-6 as a known carcinogen, with symptoms from exposure or ingestion ranging from renal damage, allergy, asthma, cancer to dermatitis.²⁹ Researchers conclude that chromium-6 contributes to an increase in charged particles, making them more reactive and inducing oxidative stress within the human body. Exposure has been associated with predicted presence of cell arrest and apoptosis, rendering both vital and nonvital cells dysfunctional and, subsequently, inhibiting proper immune response.³⁰ The Blacksmith Institute traced deposition of chromium-6 in landfills and waterways from chromate industries and found increased likelihood of infertility, birth, and developmental effects among children in households located nearby.³¹ At the molecular level, the chromium-6 toxin elicits germ cell mutations and DNA deletions affecting the overall development of the embryo in expecting mothers.³² In addition to waterborne ingestion, the Department of Toxic Substances Control found a link between the Kettleman Hills

24 California Department of Public Health, California Birth Defects Monitoring Program, & Maternal Child Adolescent Health Program. (2009, July). Birth Defects in Kettleman City.

25 California Water Board. "State Water Resources Control Board Board Meeting Session – Division Of Financial Assistance." December 6, 2016.

26 Li, Z., Ma, Z., van der Kuijp, T. J., Yuan, Z., & Huang, L. (2014). A review of soil heavy metal pollution from mines in China: pollution and health risk assessment. *Science of the Total Environment*, 468, 843-853.

27 Seed, R. B., Mitchell, J. K., & Seed, H. B. (1990, April 01). Kettleman Hills Waste Landfill Slope Failure. II: Stability Analyses. *Journal of Geotechnical Engineering*, 116(4), 669-690.

28 California Environmental Protection Agency. (2016, November 29). PG&E Hinckley Chromium Cleanup.

29 International Agency For Research on Cancer, & World Health Organization. (1990, June 13). IARC monographs programme on the evaluation of carcinogenic risks to humans. Vol 47. *Biomedicine & Pharmacotherapy*, 49.

30 He, X., Lin, G. X., Chen, M. G., Zhang, J. X., & Ma, Q. (2007, March 10). Protection against Chromium (VI)-Induced Oxidative Stress and Apoptosis by Nrf2. Recruiting Nrf2 into the Nucleus and Disrupting the Nuclear Nrf2/Keap1 Association. *Toxicological Sciences*, 98(1), 298-309.

31 Blacksmith Institute. (2007). "The World's Worst Polluted Places." New York, NY: Blacksmith Institute.

32 Environmental Protection Agency. (2016, February 5). Risk Assessment for Carcinogens.

landfill and successive public and generational health risk resulting from air exposure. Births from 2007-2010 exhibited such developmental effects; however, causal associations were not drawn resulting from the challenges posed by potential exposure by multiple chemicals from sources.

Rise in metallic contaminants serves as a threat to human populations, for low doses of hexavalent chromium (chromium-6), benzene, and arsenic are known to cause developmental issues. These health effects are subclinical, suggesting that these symptoms may not be observable but can have delayed onset. The studies conducted on the Kettleman Hills Hazardous Waste Facility site primarily focus on the effects of individual chemicals on local people, but mixed chemical exposures may also generate health effects. This disregards the cumulative chemical impact of the various individually measured chemicals.

iii. Birth Defects

In 2009, the California Environmental Protection Agency (CalEPA) and the California Department of Public Health (CDPH) directed by Governor Schwarzenegger to investigate health concerns in Kings County via the California Birth Defect Monitoring Program (CBDMP). They initially found an increase in the number of birth defects in 2008, along with public testimonials about health concerns from hazardous waste exposures.³³

The CBDMP defines a birth defect as “an abnormality that results in physical or mental disabilities or death.” Under this definition, the CBDMP identified eleven cases of infants having birth defects between 2007 and 2010.³⁴ Annually, Kettleman City has approximately thirty to sixty-four births each year, and in the two decades of tracking conducted by the CDPH all births were healthy. From 2007 to 2010, however, eleven births showed serious defects, including cleft palate and increased risk of infant mortality.³⁵ In efforts to isolate the cause(s) of birth defects, the CBDMP primarily investigated inherent genetic, medical, or pregnancy-related risk factors; behavioral or lifestyle risk factors; and potential environmental and occupational exposures.³⁶ They ultimately concluded that there is insufficient data to draw a causal relationship between birth defects and hazardous waste exposure.

None of the mothers interviewed in this study had any of the pregnancy risk factors that the CDPH screened for, including drug use, alcohol consumption, medical history, family history, and health care. While the study lacked the evidence to conclusively determine a statistically significant correlation between hazardous waste exposure and developmental abnormalities, the subjects of the study expressed concern about environmental contamination, considering all standard risk factors apart from environmental toxicity were controlled for.³⁷

This state-level conclusion, however, is met with skepticism by the local community.³⁸ The study is also not supported by independently conducted studies of hazardous waste facilities in general. In an independent study that controlled for the factor of race, comparing Latina mothers who had been exposed to hazardous waste during pregnancy to Latina mothers who had not, evidence reveals a statistically significant correlation between hazardous waste exposure and birth defects, corroborating similar conclusions of previous research.³⁹ Unlike the CBDMP study, Orr’s independent study controls for the factor of race, which may have been a confounding variable in the state-level study.

B. Is the health of communities in close proximity to hazardous waste facilities at greater risk relative to those outside district lines?

In a toxicological response study conducted by Department of Biological Sciences at North Carolina State

33 California Department of Public Health, California Birth Defects Monitoring Program, & Maternal Child Adolescent Health Program. (2009, July). Birth Defects in Kettleman City.

34 California Department of Public Health. “California Birth Defects Monitoring.”

35 Leslie, Jacques. “What’s Killing the Babies of Kettleman City?” Mother Jones. June 25, 2017. Accessed August 28, 2017.

36 California Department of Public Health, California Birth Defects Monitoring Program, & Maternal Child Adolescent Health Program. (2009, July). Birth Defects in Kettleman City.

37 California Department of Public Health. “California Birth Defect Monitoring.”

38 Wozniacka, G. (2013, July 2). California recommends expansion of hazardous dump.

39 Orr, M., Bove, F., Kaye, W., & Stone, M. (2002). Elevated birth defects in racial or ethnic minority children of women living near hazardous waste sites. *International Journal of Hygiene and Environmental Health*, 205(1–2), 19–27.

University, residential proximity to waste sites and industrial facilities was found to increase risk of chromosomal anomalies in offspring. Analyzing proximal distance to waste, researchers identified women thirty-five years or older residing within a one mile radius of a hazardous waste facility were at twice the risk of having offspring with chromosomal anomalies relative to women residing farther. This correlation is attributed to exposure to heavy metals, inducing oxidative stress on placental cells, disrupting the fetus's ability to gain oxygen and develop antioxidants for immune response.⁴⁰ Additionally, a study on elevated birth defects in children of racial minorities living near hazardous waste sites found occurrences of such effects, as researchers found increased presence of neural tube defects, spina bifida, and anencephaly in pregnant mothers relative to others expecting but residing farther from a hazardous waste facility.⁴¹

Analyzing the relationship between environmental exposure to persistent organic pollutants (POPs) and proximal distance to hazardous waste facilities, researchers found a 39% increase in toxic concentrations of Polychlorinated Biphenyls (PCB), a known carcinogen, in expecting mothers residing within five miles of a facility relative to those farther located.⁴² In risk prone populations nearby a hazardous waste facility, research on the correlation between diabetes hospitalization and proximity to hazardous waste sites indicated a statistically significant correlation between proximity to hazardous waste facilities and the frequency of diabetes and neonatal malformations.

Results indicated that residing in closer vicinity to hazardous waste facilities contributes to congenital malformation with higher malformation rates associated with greater exposure. Proximity was measured using the presence of hazardous waste sites in a census tract. Distances within a one mile radius from a waste site plotted with health risk showed a 1.5 to 5-fold risk increase in neural tube defects and heart defects in infant in these regions.⁴³

Subsequent findings studying the effects of close facility distance on health risks indicate that maternal proximity to hazardous waste sites show increased risk of approximately 12% in offspring bearing congenital malformation. Risks were specifically amplified by 32% for integument, dermis, malformations, 29% for nervous system malformations 16% in musculoskeletal system failures and 15% higher cleft palate malformations.⁴⁴ In addition, researchers found that birth weight in areas with PCB-contaminated sites exhibited a lower overall average weight, below the expected normal 2,500 grams. The average birth weight in PCB-afflicted areas was 21.6 grams less than areas without facilities, reflecting the potential effects of PCB-contaminated sites on infant birth weight.⁴⁵ Research regarding the effects of hazardous waste on reproductive health illustrated higher overall malformation associated with higher exposure, increasing risks by 63% and chemical leaks by 17%.⁴⁶

To mitigate, or lessen, the risks associated with residing near hazardous waste facilities, Michael O'Hare, Professor of Public Policy at the University of California, Berkeley, emphasizes the importance of facility sitings as means to engage in environmental research. Traditional methods of siting implement "inadequate mechanisms" to comprehensively understand individuals affected by a project as well as the project's benefits to society. O'Hare, however, proposes an increased focus on the social, political, and economic impact of constructing facilities. This proposal would increase the transparency of costs and benefits, government actors involved, and thorough environmental impact assessments. Addressing limitations and local opposition, Professor O'Hare asserts that

40 Adebambo, O. A., Ray, P. D., Shea, D., & Fry, R. C. (2015). Toxicological Responses of Environmental Mixtures: Environmental Metals Mixtures Display Synergistic Induction of Metal-Responsive and Oxidative Stress Genes in Placental Cells. *Toxicology and Applied Pharmacology*, 289(3), 534–541.

41 Orr, M., Bove, F., Kaye, W., & Stone, M. (2002). Elevated birth defects in racial or ethnic minority children of women living near hazardous waste sites. *International Journal of Hygiene and Environmental Health*, 205(1–2), 19–27.

42 Kuehn, C. M., Mueller, B. A., Checkoway, H., & Williams, M. (2007, March 10). Risk of malformations associated with residential proximity to hazardous waste sites in Washington State. *Environmental Research*, 103(3), 405-412.

43 Geschwind, S. A., Stolwijk, J. A., Bracken, M., Fitzgerald, E., Stark, A., Olsen, C., & Melius, J. (1991, May 28). Risk of Congenital Malformations Associated with Proximity to Hazardous Waste Sites. *American Journal of Epidemiology*, 135(11), 1197-1207.

44 Johnson, B. L. (1999). A review of the effects of hazardous waste on reproductive health. *American Journal of Obstetrics and Gynecology*, 181(1).

45 Baibergenova, A., Kudiyakov, R., Zdeb, M., & Carpenter, D. O. (2003, August 18). Low Birth Weight and Residential Proximity to PCB-Contaminated Waste Sites. *Environmental Health Perspectives*, 111(10), 1352-1357.

46 Johnson, B. L. (1999). A review of the effects of hazardous waste on reproductive health. *American Journal of Obstetrics and Gynecology*, 181(1).

the process will account for public health, local economies, and social factors that induce opposition within the facility siting process that prevent a true reflection of the benefits and repercussions of constructing and siting a hazardous waste facility.⁴⁷ Dependent on the failure of the siting process, parties may subsequently refer to lawsuits and county government reform to address insufficient zoning guidelines.

Current EPA regulations mandate and authorize the local government to act in accordance with the Resource Conservation and Recovery Act (RCRA), requiring districts to act within individual jurisdictions to ensure proper disposal and zoning of lower-grade hazardous waste. Nabil Al-Hadithy, the City of Berkeley's Hazardous Materials Manager, implemented a measure regarding household hazardous waste in 1995 as a means to mitigate risks from waste in local communities. By modifying the municipal code to specifically request the City of Berkeley to direct household hazardous waste to a hazardous waste facility, Hadithy was able to ensure stricter zoning standards at the local level under authority of the CalEPA. Local government municipal codes provide infrastructure for enforcement, including the ability to zone the establishment of facilities with a predetermined distance of construction away from residential and industrial areas. However, resulting from the compartmentalization of government, assessing the risk and social impacts of facilities "rarely generates coordinated evaluation of all parties," requiring a more integrative solution than solely zoning and siting criteria.⁴⁸ Regulations and zoning ordinances for hazardous waste do not currently exist within local government, and requires interdisciplinary coordination between government agencies to build a schema which promotes the proper disposal of waste whilst maintaining public safety.

C. Has the presence of hazardous waste facilities caused a transition in population, such that there are disproportionately high concentrations of low-income minority residents?

Kettleman City and the Central Valley have long been defined by immigration. In the 2014 American Community Survey Estimates, the United States Census Bureau identified Kettleman City's population as 42.1% foreign born relative to the state of California's population as 27% foreign born.⁴⁹ In a 2004 Public Policy Institute of California report analyzing data from 1970 to 2000, 58% of the population growth in the Central Valley is ascribed to immigration.⁵⁰ The Central Valley's low-wage agricultural labor is reflected in low educational attainment (i.e. not receiving high school diploma), high poverty rates, and limited English skills.⁵¹

To address health risks currently facing low-income, minority residents from hazardous waste facilities, Jasmin Vargas, from Communities for a Better Environment, emphasized community building as a form of resilience to challenge the establishment of hazardous waste facilities, noting the success of grassroots movements opposing the expansion of a waste incineration plant in East LA. In examination of health disparities in districts with hazardous waste facilities, Vargas underlined that environmental risks imposed from waste occurs both in low-income populations as well as communities of color.⁵² In a Richmond Health Survey conducted by Communities for a Better Environment, it was found that 79% of the population residing within a one mile radius of the refinery is people of color, and over 25% of this population is below the national poverty line.⁵³

Through an assessment of income, researchers conclude that individuals with an income less than fifteen thousand or between the ranges of fifteen to thirty-nine thousand had greater statistical likelihood of living within one mile of a waste facility, in comparison to individuals with incomes of forty thousand or greater.⁵⁴ Additionally,

47 O'Hare, Michael, Sanderson, D. (1993). Facility Siting and Compensation: Lessons from the Massachusetts Experience. *Policy Analysis and Management*, 12(2), 364-376.

48 Nabil Al-Hadithy, Hazardous Materials Manager, City of Berkeley Toxic Management Division, Phone, October 18, 2016, 45 minutes, Expert in understanding local government regulations and mandates overseen by the Environmental Protection Agency

49 United States Census Bureau. "2011-2015 American Community Survey 5-Year Estimates - Kettleman City CDP, California." American FactFinder. 2014.

50 Johnson, Hans P., and Joseph M. Hayes. "The Central Valley at a Crossroads: Migration and Its Implications." 2004.

51 Public Policy Institute of California (PPIC) (2004). *The Central Valley at a Crossroads: Migration and Its Implications*. PPIC electronic report.

52 Jasmin Vargas, Associate Director, Communities for a Better Environment, Phone, October 13, 2016.

53 Morello-Frosch, R., & Lopez, R. (2006). The riskscape and the color line: Examining the role of segregation in environmental health disparities. *Environmental Research*, 102(2), 181-196.

54 Morello-Frosch, R., & Lopez, R. (2006). "The riskscape and the color line." P.g. 181-196

amongst populations residing in neighborhoods host to a hazardous waste facility, the poverty rate averages 18% compared to 12% in non-host areas.⁵⁵ Income is positively correlated with residential location as higher incomes provide greater mobility to select based on environmental quality, otherwise not possible for lower income individuals. Alongside income, education serves as a statistically significant input in influencing residency, as 80.2% of individuals in the given sample had little to no high school education. In relation to the 19.8% portion of the population with a complete high school education, those with lesser education are statistically more likely to have lower incomes and reside within a one mile radius of a facility.⁵⁶ This finding reveals that the factors of both income and education are correlated with distance from waste facilities.

California currently has the largest disparity of people of color in regions with hazardous waste facilities. Within regions that contain hazardous waste facilities, people of color, on average, constitute 81% of the local population. This fraction contrasts with the average percentage of people of color of 51% in regions that do not have hazardous waste facilities.⁵⁷ After examining ethnic minority populations across the state, researchers found that 69% of people of color live in communities with clustered facilities or group of facilities. Within this breakdown, Latinos comprised 33% of the populations in occupation regions, with African Americans following at 29%. In comparison to their Caucasian counterparts, Latinos and African Americans have 2.3 and 1.8 times the probability of living in a region with clustered facilities, with an additional 50% increased risk of cancer.⁵⁸

Further analysis reveals that the percentage of African American residing within a 2.5 mile radius equated to 32.7%, constituting 69% of community's entire African American population. The same pattern is observed in the Latino population; Latinos residing within a 2.5 mile radius totaled 15% in contrast to 9.3% of the Latino population residing elsewhere. Anderton found higher percentages of each ethnic population are found in proximity to sites of a region in which they are represented among the broader population, suggesting that people of color show patterns of migration to areas where their race is reflected.⁵⁹ Not only are there higher fractions of people of color communities associated with hazardous waste facilities, but also within individual communities, a majority of the people of color population live in closer proximity to the facilities.

V. Discussion

Analysis of health implications of the Kettleman Hills hazardous waste facility can be expanded by studying impacts on residents in different cities within similar proximities to hazardous waste facilities. Researching into Kettleman City, there is one major health publication studying the impacts of birth defects from hazardous waste exposure. Outside of the California Department of Public Health, there has been limited research on the Kettleman Hills facility. With public data limited by a single research study whose findings have not been supported through repetition of the study by other researchers, however, there is greater potential for error and misinformation. Similar communities can serve as proxies to allow analysis of public health risks that may provide the capacity to predict possible future outcomes of Kettleman City as well as account for potential gaps in the limited research done on Kettleman City alone.

Research conducted by the California Department of Public Health (CDPH) lacked accounts for cumulative impacts and biological monitoring in the calculation of risk, suggesting a gap in the research as the effects of multiple exposures on public health were left unaccounted for. With this report as the primary health study analyzing health impacts from the facility in the region, residents have concern over underdeveloped data and falsified risks from results indicating an absence of association between birth defects and proximity to the

55 Bullard, R. D., Mohai, P., Saha, R., & Wright, B. (2007, March). *Toxic Wastes and Race at Twenty: 1987-2007 : Grassroots Struggles to Dismantle Environmental Racism in the United States*.

56 Mohai, P., Lantz, P. M., Morenoff, J., House, J. S., & Mero, R. P. (2009). *Racial and Socioeconomic Disparities in Residential Proximity to Polluting Industrial Facilities: Evidence From the Americans' Changing Lives Study*. *American Journal of Public Health*, 99(Suppl 3), S649.

57 Bullard, R. D., Mohai, P., Saha, R., & Wright, B. (2007, March). *Toxic Wastes and Race at Twenty: 1987-2007 : Grassroots Struggles to Dismantle Environmental Racism in the United States*.

58 Morello-Frosch, R., & Lopez, R. (2006). *The riskscape and the color line: Examining the role of segregation in environmental health disparities*. *Environmental Research*, 102(2), 181-196.

59 Anderton, D. L., Anderson, A. B., Rossi, P. H., Oakes, J. M., Fraser, M. R., Weber, E. W., & Calabrese E. J. (1994). *Hazardous Waste Facilities "Environmental Equity" Issues in Metropolitan Areas*. *Evaluation Review*, 18(April), 123-140.

facility. In a state-wide risk assessment analyzing this association, research found a 1.5 to 5 fold increase in risk contingent on presence of hazardous waste facility in region.⁶⁰ Evidently, there is risk associated with residing near hazardous waste facilities, as shown through data collected by Geschwind, who found increased neural tube defects and heart defects in infants within close proximity of a hazardous waste facility

From 1976 to 1985, EPA water tests show raised levels of total dissolved solids (TDS), establishing the facility as the probable source of origination of leachate— chemically contaminated water.⁶¹ Studies conducted on the geology of Kettleman Hills found that hazardous waste percolated into the groundwater, contaminating the water with organic compounds and heavy metals (carcinogens). The presence of chromium-6 and leachate in the groundwater within the region may explain pronounced birth defects in infants in the region due to their similarity to symptoms and developmental abnormalities caused by metal toxicity.

The issue of toxins escaping the facility is exacerbated by the hazardous waste facility's failure to properly line the slopes of the landfill, increasing health risks to the surrounding Kettleman City community.⁶² Since the facility is not properly maintained, it is susceptible to damage that can increase already harmful effects on the community, posing even further risk to the community's health. In the barrier's properly functional state, the aggregate effects of toxins pose significant implications with regard to developmental abnormalities and immune system degradation; with the added risk of damage to the facility itself, the resulting toxin release can be much more detrimental.

Chromium-6 remains a present toxin generated from the Kettleman City's hazardous waste facility; however, it is unaccounted for by State studies due to the EPA's latent guidelines framed under its drinking water and clean air standards. Current EPA standards fail to legislate "maximum legal limits" on contaminants such as chromium-6 that pose threats to the broader public.⁶³ Legal boundaries for regional health standards are far lower than levels that are scientifically considered to be acceptable. As a result, the EPA does not protect communities from groundwater contamination thoroughly enough to prevent toxin-induced disease. While members of these communities in proximity to hazardous waste facilities are within legal limits of chromium-6 consumption, they are not sufficiently protected from its effects.

From research conducted by the CDPH, the State found that there is inconclusive evidence to establish a causal relationship between the operations of the landfill and birth defects. The method in identifying one exposure at a time made it difficult to isolate causes of birth defects, so the data fails to account for the longitudinal sampling, multiple exposures, cumulative impacts, or biomonitoring necessary to reflect occurrences of birth defects from proximity to Kettleman's hazardous waste facility over time.⁶⁴

Resulting from the absence of long time measures in the study, the research conducted by the CDPH fails to comprehensively study health and developmental effects, which may develop and intensify over time. Upon analyzing the difference between areas in proximity to a hazardous waste facility versus areas that are not, researchers have identified increased risk of congenital malformations and birth defects occurring more frequently in close residence to these facilities. Kettleman City houses California's sole polychlorinated biphenyl (PCB) waste treatment facility, therefore allegedly increasing risk found in studies resulting from high contaminant exposure from known carcinogens. Research indicates increased risks in chromosomal anomalies in offspring in individuals are similarly correlated with proximity to hazardous waste facilities. Most significant health risks in this study have occurred within a one mile radius, a shorter radius than the distance of the facility to residential district; however, health risks should not be dismissed despite the three miles considering the toxicity of materials

60 Geschwind, S. A., Stolwijk, J. A., Bracken, M., Fitzgerald, E., Stark, A., Olsen, C., & Melius, J. (1991, May 28). Risk of Congenital Malformations Associated with Proximity to Hazardous Waste Sites. *American Journal of Epidemiology*, 135(11), 1197-1207.

61 California Department of Public Health, California Birth Defects Monitoring Program, & Maternal Child Adolescent Health Program. (2009, July). *Birth Defects in Kettleman City*.

62 Seed, R. B., Mitchell, J. K., & Seed, H. B. (1990, April 01). Kettleman Hills Waste Landfill Slope Failure. II: Stability Analyses. *Journal of Geotechnical Engineering*, 116(4), 669-690.

63 Donohue JM, Lipscomb JC. 2002. Health advisory values for drinking water contaminants and the methodology for determining acute exposure values. *Sci Total Environ* 288(1-2): 43-9.

64 California Department of Public Health, California Birth Defects Monitoring Program, & Maternal Child Adolescent Health Program. (2009, July). *Birth Defects in Kettleman City*.

present at the Kettleman Hills site.⁶⁵

An analysis of persistent organic pollutants (POPs) from facilities and its effect on health within a five mile radius allowed for close comparison to Kettleman City populations. Additionally, POPs provide a more precise calculation risk, with POPs accounting for airborne and waterborne exposure, showing a risk increase of 39% for those proximally located to the hazardous waste site in comparison to residents located farther.⁶⁶ Increased risk not only involves maternal risk from hazardous waste exposure, but also generational risk, involving congenital malformation. Specifically, researchers found increased risk of cleft palate, a birth defect existing in Kettleman City, whereas the CDPH found no correlation, forcing into question the legitimacy of the reports conducted by the State.⁶⁷ The disparity between studies conducted at the university level in comparison with the State demands further analysis to determine impacts from hazardous waste facility in the form of increased congenital malformations.

The hazardous waste facility's presence has shifted the demographics of Kettleman City, which experienced a 5.1% increase in Latino population.⁶⁸ Demographic shifts lead to high concentration of low-income minority residents in the Central Valley, characterized by low educational attainment and socioeconomic class. Expanding from findings that lower income is positively correlated with closer proximity to hazardous waste facilities, there are disproportionate impacts on the factor of race as it relates to socioeconomic strata.

Solutions to mitigating risks to hazardous waste facilities include potential burying of the landfills to prevent hazardous waste leakage; however, chemicals buried in the process may contribute to leachate in the groundwater. Additionally, burying the landfill prohibits treatment and disposal of hazardous waste, becoming a complication in California as it produces over 1.7 million tons of hazardous waste annually with Kettleman City processing 105,000. Resulting from California's hazardous waste production, the state is required to outsource 80% of processing, treatment, and disposal. In spite of minimal processing conducted by the Kettleman Hills landfill, at 6.2%, the facility minimizes the amount of hazardous waste transported across state boundaries.⁶⁹ Relocating the source upstream is another solution proposed by researchers to remove risks from existing water and wind streams of the hazardous waste facility. Although this solution may work to mitigate hazardous waste exposure, the relocation of residents in Kettleman City necessitates new infrastructure development, generating high costs. Kettleman City's economy is dependent on agriculture, thus prompting concern over moving agricultural production or maintaining risk for individuals commuting to the Kettleman City region for farm labor.

Analyzing environmental disparities amongst low-income communities of colors from hazardous waste facilities leads to debate over which came first: the hazardous waste facility or the concentrated Latino demographic? Kettleman City was an established rural agricultural city, with 96.1% Latinos comprising the region's population, a percentage that is 3.4% higher today.⁷⁰ With the median household income averaging \$22,409, with 43% of the population living below the national poverty level, inability to pervade social class resulting from the establishment of hazardous waste facilities allegedly increases. Economists presume the perpetual incidence of poverty amongst low-income communities' results from a tendency of people of color to situate where their communities are represented in addition to where affordable housing exists. Thus, migration occurring in these regions reflects the demographics of the broader public.⁷¹ In Kettleman City, increased health risks and proximity to hazardous waste facility contributed to a homogenous demographic, resulting in an increase in the Latino population since the establishment of the Kettleman Hills hazardous waste facility.

65 Pérez, A. C. (2015, August 07). Toxic Waste Landfill in Kettleman City, USA | EJAtlas.

66 Kuehn, C. M., Mueller, B. A., Checkoway, H., & Williams, M. (2007, March 10). Risk of malformations associated with residential proximity to hazardous waste sites in Washington State. *Environmental Research*, 103(3), 405-412.

67 Johnson, B. L. (1999). A review of the effects of hazardous waste on reproductive health. *American Journal of Obstetrics and Gynecology*, 181(1).

68 United States Census Bureau. "2011-2015 American Community Survey 5-Year Estimates - Kettleman City CDP, California." American FactFinder. 2014.

69 Botello, Esperanza. "Kettleman City: Mitigating Tensions between Landfill Incorporation & Residents." February 19, 2013, 1-12.

70 United States Census Bureau. "2011-2015 American Community Survey 5-Year Estimates - Kettleman City CDP, California." American FactFinder. 2014.

71 Anderton, D. L., Anderson, A. B., Rossi, P. H., Oakes, J. M., Fraser, M. R., Weber, E. W., & Calabrese E. J. (1994). Hazardous Waste Facilities "Environmental Equity" Issues in Metropolitan Areas. *Evaluation Review*, 18(April), 123-140.

Kettleman City's predominant Latino population calls to the concern of environmental injustice, in which disproportionate impacts experienced by one community over another results from purposeful discriminatory practices and targeting based on ethnic background and low socioeconomic status. With increased risk of congenital malformations, oxidative stress, and cancer attributed to the presence of hazardous waste facilities, Latinos remain vulnerable to decrease public safety resulting from close proximity to hazardous waste facilities. That Kettleman City, the only non-Anglo majority city in King's county, became the site of the only hazardous waste facility in the county would suggest not only racially disproportionate risk, but also a racially correlated depreciation of the quality of living.

Concurrent with racially and socioeconomically disproportionate burden, are concerns over environmental racism, and racial targeting by powerful actors. Kettleman City, as opposed to the Anglo-majority neighboring cities, saw the establishment of a hazardous waste facility. Lack of city local government and limited representation in Kettleman City contributes to suppression of public opinion by distancing the public from political participation. Resulting from lack of political clout, the city is more susceptible to powerful actors capitalizing on weaker legal systems and pushback—allowing actors to enter regions with vulnerable populations that lack mobility and legal systems to fight against the establishment of hazardous waste facilities.⁷²

Proposed solutions to mitigate effects of hazardous waste facilities involve full transparency on behalf of the establishment, addressing local opposition, understanding community values, and providing a thorough analysis of costs and benefits incurred from the project. With comprehensive facility sittings and zoning regulations, the government can work towards ensuring public safety against hazardous waste exposure for populations, inclusive of all backgrounds. Zoning regulations and facility sittings are effective tools in determining a variety of social, economic and political implications of establishing a hazardous waste facility; however, given the establishment of the Kettleman Hills landfill and years of operations, siting and zoning requirements effectively mandated today will not have effect on Kettleman City's hazardous waste facility. Additionally, Kettleman City's low rate of educational attainment and non-citizenry contribute to the inability of negotiated siting and zoning requirements.

Beyond facility sittings and zoning regulations, which are not feasible reforms for Kettleman City, resolutions between state and community groups may reach agreement in acting towards the public good. Through a joint resolution with physical remediation involving environmental monitoring and asthma intervention programs, state agencies agreed to work in collaboration with the larger community to enforce environmental quality. With the voluntary participation of authorizing players as well as residents, populations affected by hazardous waste facilities, Kettleman City will work towards ensuring proper siting and mitigation of health concern that persist in the given community resulting from hazardous waste exposure. Additionally, collaboration entails acceptance and adherence to the Civil Rights Act, ensuring no misuse of discriminatory practices, relevant in consideration of permit expansion, and renewal.

⁷² Greenaction for Health and Environmental Justice, *El Pueblo Para el Aire y Agua Limpia de Kettleman City*. (2016, August 10). *Landmark Agreement Reached to Benefit Environmental Justice Communities and Resolve a Title VI Civil Rights Complaint on Hazardous Waste Permitting Decision* [Press release]. Greenaction.

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