Inequality at the Tap: Explaining Shortcomings in Safe Water Access in Los Angeles’ Mobile Home Communities

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Executive Summary

From its beginnings, the livelihood of Los Angeles has depended on water. However, a fragmented and complex regulatory system of oversight and a lack of coherent water rights in Los Angeles have played a detrimental role on furthering research on equitable access to a continuous stream of safe drinking water by our most vulnerable communities.

This research explores the relationship between socioeconomic inequality and access to safe drinking water in Los Angeles County. Many studies have assessed the linkages between racial and income inequality and the environmental health of disadvantaged communities. While the nexus have been documented in urban areas for air quality and the placement of waste facilities, the relationship between inequality and access to safe drinking water has rarely been addressed.

To fill this gap in social and environmental justice knowledge, the research presented in this paper examines the quality of water delivered to mobile home parks, which represent an increasingly large proportion of the total population in the U.S. The research hypothesizes that water quality is substandard because water quality standards are under-regulated or under-enforced in mobile home parks, partly because the low-income and minority residents have little political influence.

Using public water system data from the Permits, Inspection, Compliance, Monitoring, and Enforcement (PICME) database, poverty and demographic data from the American Community Survey (ACS), and geographic information systems (GIS), we test the association between water quality and mobile parks. The quantitative spatial analysis examines the prevalence (relative frequency) of violations in mobile home parks in Los Angeles County relative to the county, and the prevalence of violation among categories of mobile home parks differentiated by income and by racial composition.

We hope that the findings and insights from this research will help identify interventions and actions that can improve water quality for these communities. We also hope to put this issue on the academic research agenda so that the emerging focus on cumulative impacts of environmental inequalities includes the continuous access to safe drinking water.

Key Findings

- There is a dearth of research on the access to sufficient water quantity and quality in urban areas with a U.S. context;
• The lack of comprehensive and accurate digital maps of public water system service areas for California and the large but fragmented regulatory oversight poses a significant challenge in collecting and disseminating data useful to conduct research to improve our understanding of the relationship between drinking water, health, and the environment;
• Systems with at least one trailer park community perform better than those without, even after controlling for population size;
• Mobile-home parks with their own water systems exhibit more violations per water system network than other systems;
• Our reduced model presents evidence that it is in fact poverty, rather than mobile home park management, drives water quality. However, given the small sample size of the reduced model, we hesitate to draw any firm conclusions regarding the competing explanations of exclusive mobile home systems and poverty in explaining water quality violations at the network level.

Policy Recommendations
• There is a need for an improved system of service area tracking. According to the California Environmental Health Tracking Program, quality geographic area will not only further the understanding of the relationship between drinking water, health, and the environment, but will also improve public health prevention and response as well as enhance emergency preparedness;
• There is a need for easily accessible information on the quality of water provided by water systems, including a centralized location for the dissemination of such information that is continuously updated;
• Due to the regulatory framework under which water systems operate, the analysis in this report excludes private domestic well systems and the impact of this exclusion on the results is unknown (USGS, 2009), therefore, a closer look at water quality at these locations is merited;
• A closer examination of mobile home parks is needed in two areas: the Antelope Valley, where water systems with a higher frequency of violations appear to be clustered, and South Los Angeles, where mobile home parks appear to be clustered.
**Introduction**

Many U.S.-based studies have assessed the linkages between racial and income inequality and the environmental health of disadvantaged communities. While the nexus have been documented in urban areas for air quality and the placement of waste facilities (e.g., Houston et al., 2004; Morello-Frosch et al., 2002; Daniels and Friedman, 1999), the relationship between inequality and access to safe drinking water has rarely been addressed (Evans and Kantrowitz, 2002). Every Californian has a right to safe drinking water (Johnson 2012), the lack of a coherent system of water rights in LA (qtd in Rosenberg 2012), and the lack of research on inequality and water, puts our most vulnerable communities at risk.

To fill this gap in social and environmental justice knowledge, this paper will focus on the quality of water delivered to mobile home parks, which represent an increasingly large proportion of the total population in the U.S. (Hart, Rhodes and Morgan, 2002).¹ The research hypothesizes that water quality is substandard because water quality standards are under-regulated or under-enforced in mobile home parks. We test the association between water quality and mobile parks by conducting a quantitative spatial analysis of the prevalence (relative frequency) of violations in mobile home parks in Los Angeles County relative to the county, and the prevalence of violation among categories of mobile home parks differentiated by income and by racial composition.

This paper is organized into three sections:

- **Section 1** provides a review of the existing literature on the relationship between socioeconomic inequality and environmental inequity, with a focus on safe drinking water in LA County. We find there is a substantial academic literature on the lack of access to sufficient water quantity and quality in urban areas of low and middle income countries, where lack of access is not only differentiated by income but by race-ethnicity and marginalization within the urban area. While the issue of insufficient access is not nearly as ubiquitous in the U.S. as in developing countries, this difference does not explain the near complete dearth of research on this issue in the U.S. context.

- **Section 2** provides an overview of water systems in California, presents the data and methodology, highlighting any limitations to the approach used in this paper. We show that the lack of comprehensive and accurate digital maps of public water system service

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¹ Between 1950 and 2000, mobile home’s percentage of the total housing stock substantially rose from 0.7% to 7.6% (Census, 2011).
areas for California and large but fragmented regulatory oversight poses a significant challenge in collecting and disseminating data useful to conduct research to inform policy on the subject.

- Section 3 presents the preliminary result and a discussion of the next steps to improve this research. We find that the mere presence of a mobile home park within a water system does not increase the number of violations per person within the system. In fact, systems with at least one trailer park community perform better than those without, even after controlling for population size. More interestingly, we find that exclusive mobile-home water systems exhibit more violations per network than other systems. Finally, our reduced model presents evidence that it is in fact poverty, rather than mobile home park management, which is driving water quality. However, given the small sample size of the reduced model, we hesitate to draw any firm conclusions regarding the competing explanations of exclusive mobile home systems and poverty in explaining water quality violations at the network level.
Section 1: Review of Literature

Health disparities are often attributed to individual health behaviors; however, these only account for a small fraction of disparities (Brulle and Pellow, 2006). Starting with the seminal and influential publications by the United Church of Christ’s Commission for Racial Justice in 1987, many studies have assessed the linkages between racial and income inequality and the environmental health of diverse communities. These studies focused on race-ethnicity and the placement of hazardous waste facilities or economic status and exposure to polluted air (e.g., Freeman, 1972; Berry 1977; Bullard, 1983; GAO 1993). Overall, the studies showed race was a factor in the placement of hazardous waste facilities in the US and that the poorer a neighborhood, the more polluted its air (Szasz and Meuser, 1997).

While the early observations were often contested for not being sufficiently scientific, such as not sufficiently addressing reverse causality, the work explicitly linked research and advocacy, and grounded the issues of environmental exposure to race in the environmental justice movement (Szasz and Meuser, 1997; Ringquist, 2005). In recent years, there has been a growing body of empirical research documenting the effect of exposure to environmental pollution onto the production of health inequities (qtd in Ong, 2010:1). However, the literature continues to be limited in scope focusing on one pollutant or aspect of inequality without consideration for cumulative impacts (Morello-Frosch et al., 2002; Brulle and Pellow, 2006). For instance, in the LA and the wider Southern California Region, these linkages are usually assessed around air quality (e.g., Morello-Frosch et al., 2002; Houston et al., 2004; Pastor et al., 2006). The focus on air quality in Los Angeles is likely due to the importance of the area to global trade and movement of goods.

Within the larger body of research on environmental justice, the relationship between income inequality and access to safe drinking water has rarely been addressed in the context of the U.S. (Evans and Kantrowitz, 2002; Balazs et al., 2011). On the other hand, there is a substantial academic literature on the lack of access to sufficient water quantity and quality in urban areas of low and middle income countries. Lack of access is not only differentiated by income but by race-ethnicity and marginalization within the urban area. While the issue of lack of access is not nearly as ubiquitous in the U.S. as in developing countries, this difference does not explain the near complete lack of research on this issue in the U.S. context.

When the relationship between income and access to safe drinking water is addressed in the U.S., the focus is usually on rural areas, the accumulation of specific contaminants such as nitrates from agricultural runoff into groundwater, and the effects on farm workers (e.g., Ward et al., 2005; Pontius 2005; Moree and Matalon 2011; Balazs et al., 2011). In metropolitan areas
like Los Angeles, the lack of research on the subject may be due to the massive infrastructure developed to import, store, combine and redistribute water—that is the reliance on aqueducts and not local groundwater or rainfall (as in rural areas) to meet its increasing demand—and the complexity and intricacies that these large-scale water projects pose to developing a sound research framework for teasing out causal impacts on water quality. Hence, within urban settings, the issue of water quality is usually assessed within the regulatory water system flow such as quality at the water source, the treatment and storage facilities (e.g., Ellis and Wycoff 1981), or municipal waste (e.g., Brown 1987). The lack of research on the subject may also be due to the stringent framework that regulates these water delivery systems. The water is simply assumed to be safe.

In 2009, with the EPA’s initiation of activities to formalize the assessment and consideration of environmental justice in its regulatory process as mandated under the 1994 Executive Order 12898, there has been a renewed interest in the relationship between income inequality and water quality (Nweke et al. 2011). In particular, there is a revived interest in the assessment of previous evidence on the issue, the methodologies used in these studies, as well as on the infrastructure that is delivering drinking water (e.g., Nweke et al. 2011; VanDerslice 2011). This is an important shift given that Los Angeles faces two substantial issues: contamination of the local groundwater supply, which has disproportionately burdened low-income people and people of color (Pulido, 2000), and an inner-city with older housing and infrastructure increasingly plagued by poverty as a result of spatial socioeconomic shifts.

But considering the built-up density of the metropolitan area, Los Angeles County also has a large number of trailer parks – 595 active parks and 77 closed parks.² As it relates to mobile home parks, we find in a host of studies that water quality standards at the state level tend to be under-regulated or enforced in mobile home parks, and consequently owners or managers of parks provide poor service (MacTavish, et al., 2006; Larrance et al., 2007). Mobile home parks are primarily occupied by households which are poorer and more racially diverse than the general population (MacTavish, et al., 2006). Further, mobile home parks are often located in semi-urban, unincorporated areas which are not subjected to the same standards as more traditional urban cores or suburbs. The lack of close regulation has led to a host of environmental problems, including deficiencies in clean water provision.

The canonical research on water quality in mobile home communities has emerged from research on colonias—which are defined as housing subdivisions without basic infrastructure

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² Mobile home park count was tabulated by authors from the mobile home park and RV listing maintained by the State of California Department of Housing and Community Development (HCD). The list can be accessed online at [https://ssw1.hcd.ca.gov/ParksListing/faces/parkslist/mp.jsp](https://ssw1.hcd.ca.gov/ParksListing/faces/parkslist/mp.jsp). The data were retrieved February 20, 2013.
(Mukhija and Monkkonen, 2006) — clustered near the Mexican border in Texas, as well as in Arizona and New Mexico (Ward, 1999; Olmstead, 2004). However, designated *colonias* also exist in exurban Imperial County in California, which is not near the border (Mukhija and Monkkonen, 2006; Mukhija and Monkkonen, 2007). The settlements in all of these areas suffer from poor water quality. Moreover, water quantity is also constrained, in addition to sub-standard quality. In addition to documenting inadequate access to clean water in these communities, Mukhija and Monkonnen argue that the use of the term ‘colonias’ for substandard housing is racially charged (2007). This highlights the potential confluence of poor quality water and racial discrimination, which we explore further in our study.

However, the issue of inequity in water access for marginalized housing stock is increasingly coming to light, both in California and in other states, where the EPA or local government has pursued legal action against mobile home park owners for violations of state health standards (Morton, 2012).

In summary, there are three key takeaways about the existing literature and the intersection of drinking water, mobile home parks, and urban areas:

1. The U.S. environmental justice literature tends to be limited to certain subject areas, often passing over the issue of water quality;
2. When access to clean and safe drinking water is addressed, the focus is not on urban areas; and
3. In general, there is little research on mobile home parks across different bodies of knowledge due to data concerns.
Section 2: Methodology & Overview of Water Systems

This research hypothesizes that water quality is substandard because water quality standards are under-regulated or under-enforced in mobile home parks, due in part because the low-income and minority residents have little political influence (MacTavish, Eley and Salamon 2006; Larrance, et. al 2007). We test the association between water quality and mobile parks by conducting a quantitative spatial analysis of the prevalence (relative frequency) of violations in mobile home parks in Los Angeles County relative to the county, and the prevalence of violation among categories of mobile home parks differentiated by income and by racial composition.

Our dependent variable is the prevalence of violations (number of citations divided by total households). According to the EPA’s Safe Drinking Water Information System (SDWIS) there are 179 public community water systems in Los Angeles County, servicing from as little as 25 to over 260,000 persons year-round. Between February 2002 to February 2012 more than 50% of these community water systems received a health-based or monitoring and reporting violation. Using water violation data from SDWIS, poverty and demographic data from the American Community Survey, and geographic information systems (GIS), the specific questions we seek to answer are:

1. How does the frequency of water quality violations in Los Angeles County compare to that of mobile home parks?
2. What is the prevalence of violations in LA County compared to mobile home parks?
3. Is lower water quality correlated with lower SES factors in mobile parks?

To answer the first question, we focus on the number of violations received by all water systems in the county and compare the frequency to the number received by systems servicing mobile home parks exclusively. The second question refers to the prevalence of violation in LA County compared to mobile home parks. To answer this question we follow the same process used to answer the first question.

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3 Database can be accessed at [http://www.epa.gov/enviro/facts/sdwis/index.html](http://www.epa.gov/enviro/facts/sdwis/index.html). The numbers cited are for a search executed on May 21, 2012 with results based on data extracted February 7, 2012. Note that the number of systems that move from active to inactive changes periodically. Public community water systems serve the same people year-round in homes or businesses.

4 Health Based Violations are those issues because the amount of a contaminant exceeded safety standard (MCL) or water was not treated properly. Monitoring and Reporting and Other Violations are issued when the system failed to complete all samples or sample in a timely manner, or had another non-health-based violation. A significant monitoring violation means the system failed to take a large percentage of the required samples. Non-significant monitoring violations indicate that the water system failed to take some of the required samples, but did do some of the required sampling.
Prevalence is defined as:

\[
\frac{[\text{Total Violations in Water Systems}]}{[\text{Total Population Served in Same Water Systems}]}
\]

There are various complementary datasets (both State and Federal) that provide violation information on public water systems. For this report, we focus mainly on system violation data from the Permits, Inspection, Compliance, Monitoring, and Enforcement (PICME) database maintained by the CDPH. We assume that not all systems have received a violation and that therefore the violation data may exclude some systems; therefore, we compliment the PICME data with information from the Federal Safe Drinking Water Information System (SDWIS) database\(^5\) to identify systems with that may be missing from the PICME datasets.

Although the SDWIS also provides updated water violations information for PSWs, the database is limited to public water systems reported to EPA by the states for the fiscal year ended September 2008.\(^6\) The PICME data provide the most comprehensive and up-to-date information on violations as the information is maintained by the State. Aside from the time lag, another downside to the SDWIS database is the tedious process to retrieve data. Therefore, this dataset was primarily used to verify the PICME data and find any systems that may be missing from the PICME dataset.

PICME data were provided by the from CDPH Division of Drinking Water and Environmental Management, Office of Information Systems, which are overseen by the Center for Environmental Health. The PICME database includes basic system related information, such as:

- Population served,
- Status of a system (active or closed),
- District number the system is in,
- Enforcement action taken
- Date of when the action took place, and
- Compliance status of the system.

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\(^5\) The CDPH also has two databases that can be used to identify systems that may be excluded from the PICME database. These two databases are used by the laboratories that test water quality and report to the Department through the Electronic Data Transfer (EDT) program. The two databases are the SITELOC and WATSYS, both of which complement each other. I have spent substantial time reviewing these datasets; however, there are inconsistencies with the way the PICME reports the “district” geography from the definition used by EDT. I am awaiting a response from the CDPH about these differences. Since the SDWIS is a federal database that was last updated in 2008, I assume that the EDT databases are likely to be current since they are locally maintained. The EDT databases are found at: [http://www.cdph.ca.gov/certlic/drinkingwater/pages/EDTlibrary.aspx](http://www.cdph.ca.gov/certlic/drinkingwater/pages/EDTlibrary.aspx)

\(^6\) The SDWIS is accessible online at: [http://www.epa.gov/enviro/facts/sdwis/search.html](http://www.epa.gov/enviro/facts/sdwis/search.html). See footnote number 2 for additional information on the database.
The dataset also provides information on associated violations that triggered the enforcement action. We obtained two PICME datasets, one obtained in June 2011 for a fair housing assessment conducted by Professor Paul Ong from the UCLA Luskin School of Public Affairs, and a second obtained for the purposes of this project in December of 2012. The most recent dataset we received did not include detailed enforcement action information and therefore we opted to use the 2011 dataset.² It includes enforcement actions taken between May 6th, 1989 and June 10th, 2012.

Finally, we obtained tract-level data from the 2007-2011 American Community Survey (ACS). We use this data to control for socioeconomic status in the determination of the relationship between mobile homes and water system violations. Wherever possible, we aggregated data from the scale of the tract to the geography of the entire water system. However, we were only able to match ACS data to 74 water systems, which represents less than one-fourth of the total number of systems for which we collected violation data. The results of our analysis using this data are detailed below.

Defining Geographical Boundaries to Identify Demographic Data

The greatest limitation of the methodology is determining which water system serves a particular neighborhood, which limited our ability to identify demographic data. There are no comprehensive and accurate digital maps of public water system service areas for California. Currently, the California Environmental Health Tracking Program (CEHTP) Drinking Water Systems Geographic Reporting Tool (or Water System Boundary Tool) is under development. This tool is specifically for use by California public water systems, local primacy agencies, and the CDPH Drinking Water Program. A public dataset has been made available (CEHTP 2012), but the geographic boundaries in the dataset are either self-reported by water system personnel or staff from State water districts.

Just as there no complete datasets that identify the geographical service area of a water system, there are there datasets that classify a water system as serving a mobile home park or not. Further, a mobile home park may have its own system or be served by a larger system. To address these issues, we manually classified PICME and SDWIS systems as serving mobile home parks or not by using the name of the system, which usually includes whether the system is a mobile home park or not. RV parks and trailer parks were included as mobile home parks. In addition to this, we geocoded the list of 595 active parks and 77 closed parks from the

² The most recent data was provided via email on Monday, December 17th, 2012 at about 2:30pm and included information on statewide enforcement actions entered into the PICME database from May 6th, 1989 to December 7th, 2012. The first dataset was received on June 6, 2011 at 10:27 am.
California Department of Housing and Community Development to identify systems that may fall within the boundaries reported in the Water Systems Boundary Tool.\(^8\)

According to various maps by Drinking Water Program,\(^9\) Los Angeles County is overseen by four of the twenty-two district offices of the program: 7, 15, 16, and 22. However, a closer examination of the violation data shows that a district 49\(^10\) should also be included. Each system is given a unique identification number comprised of:

\[
\text{County number (as identified in by the EDT databases)}
\]
\[
+ \text{system type}
\]
\[
+ \text{a sequence number}
\]

**Defining a Public Water System (PSW)**

The units of observation for this paper are public waters systems. The EPA defines a PSW as “a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals.”\(^11\) According to the EPA's Safe Drinking Water Information System (SDWIS) website there are three types of PSWs:

- Community Water Systems, which serve the same people year-round (e.g., in homes or businesses);
- Non-Transient, Non-Community Water Systems serve the same people, but not year-round (e.g., schools that have their own water system); and
- Transient Non-Community Water Systems that do not consistently serve the same people (e.g., rest stops, campgrounds, gas stations).

According to SDWIS, as of November of 2012, there were at least 556 closed and active water systems in Los Angeles County. Of these 284 were classified as community systems servicing

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\(^8\) Mobile home park count was tabulated by authors from the mobile home park and RV listing maintained by the State of California Department of Housing and Community Development (HCD). The list can be accessed online at [https://ssw1.hcd.ca.gov/ParksListing/faces/parkslist/mp.jsp](https://ssw1.hcd.ca.gov/ParksListing/faces/parkslist/mp.jsp). The data were retrieved February 20, 2013.


\(^11\) Service connections or population served are defined as “a system-generated count of the total retail population served by a water system.” See [http://oaspub.epa.gov/enviro/sdw_metadata_v2/get_metadata?tab_nm=pws&col_nm=RETPOPSRVD](http://oaspub.epa.gov/enviro/sdw_metadata_v2/get_metadata?tab_nm=pws&col_nm=RETPOPSRVD)

Definition of a (PWS) can be found in the SDWA Section 1401(4) as Amended by the 1996 SDWA Amendments, August 5, 1998 Federal Register notice. See [http://water.epa.gov/infrastructure/drinkingwater/pws/pwsdef2.cfm](http://water.epa.gov/infrastructure/drinkingwater/pws/pwsdef2.cfm)
from as little as 35 to over 3,825,279 persons year-round.\textsuperscript{12} 240 were considered transient non-community systems, and the remaining 41 non-transient non-community. The Los Angeles Department of Water and Power, which serves all of the city of Los Angeles, is by far the largest community system in the county (EPA, 2012). We estimate that of these systems, 112 service mobile home parks; however, we were unable to confirm this number given that no regulatory agency tracks this information.

The EPA also classifies PSWs according to the number of people they serve (EPA, 2012):
- Very Small water systems serve 25-500 people
- Small water systems serve 501-3,300 people
- Medium water systems serve 3,301-10,000 people
- Large water systems serve 10,001-100,000 people
- Very Large water systems serve 100,001+ people

Two thirds of the mobile home parks with their own systems are served by very small networks, whereas the remaining third are served by small systems. Not surprisingly, as water systems get larger, they are more likely to contain at least one mobile home within their boundaries. For instance, 75% of very large systems serve at least one park, whereas only 17% of very small systems do so.

\textbf{Regulatory Framework of PWS & Violation Data}

In California, all PSWs are regulated by the Drinking Water Program within the Division of Drinking Water and Environmental Management of the California Department of Public Health (CDPH).\textsuperscript{13} Under the Safe Drinking Water Acts (SDWAs), no person may operate a public water system without having secured a domestic water supply permit from CDPH (CDPH, 2007). While there are many responsibilities for owners or those otherwise operating a water system the CDPH lists nine basic responsibilities in their permitting application forms (2007), including:

1. Knowledge of and compliance with all drinking water regulatory requirements

\textsuperscript{12}The database of all public systems can be accessed at http://www.epa.gov/enviro/facts/sdwis/index.html. There were a total of 169 closed or inactive water systems in LA County. The numbers cited are for a search executed on December 12, 2012 with results based on data extracted November 8, 2012; however, the number is only for those systems reported by states to the EPA at the end of the 2008 fiscal year.

\textsuperscript{13}The Center for Environmental Health administers programs that protect the public from unsafe drinking water, among other things. The Center comprises the Division of Food Drug and Radiation Safety and the Division of Drinking Water and Environmental Management. According to the Drinking Water Program’s website, bottled water or vended water and private domestic wells are not regulated by the Drinking Water Program. Bottled and vended water are regulated as food by CDPH’s Food and Drug Branch and private wells are not regulated at all by the State of California. See the Drinking Water Program website: http://www.cdphe.ca.gov/programs/Pages/DWP.aspx
(2) Obtaining and maintaining an adequate source and quantity of water  
(3) Providing appropriate treatment of the water supply  
(4) Providing continuous monitoring of the quality of the water  
(5) Keeping the consumers informed  
(6) Responding to emergencies

In accordance with the SDWAs, a system is subject to health-based and monitoring or reporting standards and therefore operators and/or owners of a system are also subject to enforcement actions if a system is in violation if it does not comply with the standards. According to the CDPH (2011), health based violations are issues because the amount of a contaminant exceeded safety standard (MCL) or water was not treated properly.

Monitoring and reporting and other violations are issued when the system failed to complete all samples or sample in a timely manner, or had another non-health-based violation. A significant monitoring violation means the system failed to take a large percentage of the required samples. Non-significant monitoring violations indicate that the water system failed to take some but not all of the required samples, but did do some of the required sampling. The Department is obligated by the EPA to address any violation incurred by any drinking water PSW as well as any initial and subsequent enforcement actions to ensure a system returns to compliance (PICME Guide, 2007). Preliminary analysis of the data presented in this report makes no distinction between health-based and monitoring or reporting violations.

Limitations of Data & Methodology

- Underreporting violations of drinking-water standards by states is also a known issue (See GAO, 2011);
- The preliminary analysis of the data presented in this report makes no distinction between health-based and monitoring or reporting violations.
- It is possible that a large number of mobile home parks are not accounted for given that service area boundaries are incomplete;
- There is a time lag between when a violation first begins, when it is found by testing laboratories, when enforcement orders are placed, and when corrective actions are finally taken. No consideration was given to these temporal differences;
- The prevalence was calculated using the population serviced as provided in the PICME dataset. It is likely that this count is not updated with time as the same count is reported for violations at different time periods for the same system and there is also a discrepancy between the PICME and SDWIS counts;
• An enforcement action may be associated with multiple violations or recurring violations. For this paper only unique violations were considered given that no information was provided on the violations for our newer dataset;

• Other indicators could have been used to identify unsafe water systems, such as water quality test results for regulated contaminants; however, due to the limited scope of this paper these were not explored;
Section 3: Preliminary Results

We now turn to the presentation and analysis of preliminary findings from our data collection. We were able to collect data on the number of violations, the population of the system served at the time of the violation, and the presence of at least one mobile home park within the system for 337 unique systems. Further, we were able to match census data to 74 systems, one-third of which were mobile home-only systems. For these systems, tract level data on poverty, racial/ethnic makeup of the tract and housing tenure status was aggregated to the system level.

Table 1 shows descriptive results for the full universe of systems and then for the systems for which we have census data. About one-third of all systems have at least one mobile home park, whereas just over ten percent of all systems exclusively serve these communities. Generally, the systems for which we were able to collect census data are smaller than the overall system average. They have a slightly above average poverty rate, compared to the U.S. average, and these areas have a higher proportion of Hispanics than the general population.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>All Systems (n=297)</th>
<th>Systems with Census Data (n=74)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a mobile home park</td>
<td>33%</td>
<td>100%</td>
</tr>
<tr>
<td>Is an exclusive mobile home park system</td>
<td>13%</td>
<td>36%</td>
</tr>
<tr>
<td>Average population size</td>
<td>61,575</td>
<td>43,365</td>
</tr>
<tr>
<td>Percent of households living in poverty</td>
<td>NA</td>
<td>16%</td>
</tr>
<tr>
<td>Percent of households self-identifying as Black</td>
<td>NA</td>
<td>7%</td>
</tr>
<tr>
<td>Percent of households self-identifying as Hispanic</td>
<td>NA</td>
<td>52%</td>
</tr>
<tr>
<td>Percent of households self-identifying as Asian</td>
<td>NA</td>
<td>10%</td>
</tr>
<tr>
<td>Percent of households renting</td>
<td>NA</td>
<td>39%</td>
</tr>
</tbody>
</table>

We then proceed to inferential statistical analyses. The outcome of interest in both models is the number of violations per system, adjusted for the population served by the system. We use Ordinary Least Squares (OLS) regression to model the relationship between the dependent
variable the independent variables of interest, the presence of a mobile home park and the identity of exclusive mobile home systems, and the control socioeconomic variables. We note that the percent renting their housing was correlated with the percent Hispanic and the average population size at above the .30 level (simple Pearson correlation), but that no other independent exhibited potential multicollinearity.

Table 2 shows the results of our two models. We explain about ten percent of the variation in violations per person in our model for all systems in Los Angeles County (Model 1). Both of our independent variables of interest are associated with violations at the .01 level of statistical significance. While the presence of at least one mobile home within the system is negatively correlated with the number of violations per person, systems that exclusively serve mobile home parks are much more likely to have more average violations. The mobile home identifier within systems may be reflecting system size (larger systems tend to have at least one mobile home within their service remit), but the indicator variable for systems that only serve mobile home parks clearly shows that these systems receive below-average service. These results suggest that disparities between self-serviced mobile home parks and other water systems, even very small ones, merit more research.

Table 2: Regression Models

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a mobile home park</td>
<td>-.07 (.26)***</td>
<td>---</td>
</tr>
<tr>
<td>Is an exclusive mobile home park system</td>
<td>.15 (.36)***</td>
<td>.056 (.19)</td>
</tr>
<tr>
<td>Average population size</td>
<td>-.001 (-.05)</td>
<td>.006 (.02)</td>
</tr>
<tr>
<td>Percent of households living in poverty</td>
<td>---</td>
<td>.01 (.56)</td>
</tr>
<tr>
<td>Percent of households self-identifying as Black</td>
<td>---</td>
<td>-.35 (.20)</td>
</tr>
<tr>
<td>Percent of households self-identifying as Hispanic</td>
<td>---</td>
<td>-.10 (.16)</td>
</tr>
<tr>
<td>Percent of households self-identifying as Asian</td>
<td>---</td>
<td>-.08 (.07)</td>
</tr>
<tr>
<td>Percent of households renting</td>
<td>---</td>
<td>.003 (.004)</td>
</tr>
<tr>
<td>Sample size</td>
<td>n= 297</td>
<td>n=74</td>
</tr>
<tr>
<td>Adjusted R-Square</td>
<td>0.09</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Results are presented as coefficients, with Beta weights in parenthesis.
* significant at the .10 level, ** significant at the .05 level, *** significant at the .01 level
Model 2, which includes all socioeconomic control variables but has a greatly reduced sample size, explains nearly half of the variation in violations per person across water systems. In this model, however, the identity of exclusive mobile home systems does not drive the results. Indeed, this variable is not significantly correlated with violations at standard statistical thresholds. This lack of significance appears attributable to the remarkable explanatory power of poverty in predicting the number of violations per person. Poverty is significantly correlated with violations at the .01 level, and the variable’s Beta weight suggests that it explains about three times as much of the variation in violations as any of the other variables. After controlling for these factors, race/ethnicity and household tenure are not significantly correlated with the outcome of interest.

Combined, the results of these models appear to suggest that, first, the mere presence of a mobile home park within a water system does not increase the number of violations per person within the system. In fact, systems with at least one trailer park community perform better than those without, even after controlling for population size. More interestingly, we find that exclusive mobile-home water systems exhibit more violations per network than other systems. Finally, our reduced model presents evidence that it is in fact poverty, rather than mobile home park management, which is driving water quality. However, given the small sample size of the reduced model, we hesitate to draw any firm conclusions regarding the competing explanations of exclusive mobile home systems and poverty in explaining water quality violations at the network level.

Map 1 on the following page provides a visual representation of the location of mobile homes with their own water systems. A number of these systems with violation appear to be clustered in the northeast of Los Angeles County in the Antelope Valley area.

**Next Steps**

Given the sparse literature on mobile home parks and water, future researcher on the subject is needed which examines:

- The distributions of income by race/ethnicity, education, household size and age of mobile home park residents. Age should be considered because some of these residents may be elderly households, which may result in lower household income since often times elderly households rely on both private and public pensions as their source of income. This could be examined using either microdata from the American Community Survey data or American Housing Survey data;
- Identifies how many mobile home parks exist in Los Angeles and California and how many are actually serviced by its small water system. The California Department of Housing and Community Development maintain a database on active and closed mobile home parks, since these parks also require an operating permit;
- Develop a second prevalence measure using data about the surrounding neighborhood in which mobile home parks are located;
- Research on water standard violations of very small water systems, for which there are different regulatory standards; and a
- Closer examination of mobile home parks in South Los Angeles where these seem to be visibly clustered.
Conclusion

From its beginnings, the livelihood of Los Angeles area has depended on water. Water in the City of Los Angeles is consistently judged to be among the safest in the nation. We cannot forget that this generalization does not apply to other municipalities in the greater Los Angeles area, especially as it is confronted with two large issues: the need to clean its groundwater supplies and aging infrastructure, particularly in the older cities and suburbs.

Research on water quality and income has important policy implications. This report shows a need for:

- An improved system of service area tracking. According to the California Environmental Health Tracking Program, quality geographic area will not only further the understanding of the relationship between drinking water, health, and the environment, but will also improve public health prevention and response as well as enhance emergency preparedness (2012);

- A research agenda in academia that with focus on cumulative impacts of environmental inequalities that includes drinking water quality;

- Due to the regulatory framework for which water systems operate, the analysis in this report excludes private domestic well systems and the impact of this exclusion on the results is unknown (USGS, 2009), therefore, a closer look at water quality at these locations merits a closer look.
References

Balazs, C., Morello-Frosch, R., Hubbard, A. and I. Ray. Social Disparities in Nitrate-Contaminated Drinking Water in California’s San Joaquin Valley. Energy and Resources Group, School of Public Health, and Environmental Science Policy and Management, University of California, Berkeley, California.


