**Environmental Justice, Community Awareness**

**& the San Francisco Wastewater Treatment System**


***Abstract***

The San Francisco Wastewater Treatment System (WWTS) is a combined system which collects both sewer and storm water. There are three treatment plants within the city. Burden spawned by the San Francisco Wastewater Treatment System is disproportionately distributed among its residents. Our research seeks to further discover the association between environmental justice and community awareness and their individual association with the San Francisco Wastewater Treatment System. Our research builds upon the original research conducted by Dr. Sheldon Gen. The researchers, conducted regression analyses which looked at several demographic independent variables comparing them to various dependent questions. Our findings support some of our hypotheses. We found that environmental justice is a real concern for residents and that those who showed concern and awareness were those who, with the exception of Southeast residents, were more likely to be affected by the treatment system and its possible upgrades.



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## Introduction

San Francisco's wastewater treatment system is a combined system which collects both sewer and storm water. The sewer system reduces pollution in the San Francisco Bay and Pacific Ocean by treating urban runoff and sewage before it flows to the Bay and Ocean. The collection system consists of approximately 900 miles of underground pipes throughout the City (SFPUC).

"The SFPUC treats and discharges approximately 84 million gallons per day of treated wastewater during dry weather to the San Francisco Bay and Pacific Ocean. During wet weather, with additional facilities and increased operations, the plants can treat approximately 465 million gallons of combined flows per day." There are three treatment plants located in San Francisco: the Northpoint Treatment Facility, the Southeast Treatment Plant and the Oceanside Treatment Plant (SFPUC).

In San Francisco, a disproportionate amount of wastewater is treated in one neighborhood. Our research focuses on community awareness and environmental justice issues associated with the residents of San Francisco and the Wastewater Treatment Plant (WWTP). Our analysis will be based on survey response and demographic characteristics of the respondents.

## Literature Review

*Question:* In the city of San Francisco, are community awareness and environmental justice issues about the wastewater treatment system influenced by demographic characteristics?

The purpose of this research is to learn more about community awareness and environmental justice regarding the WWTP and the residents of San Francisco. Specifically, we

are interested in the levels of community awareness and environmental justice and how these variables are influenced by demographic factors.

The original data was collected for an initial study about the residents of San Francisco and their understanding of various issues regarding the WWTP. Additionally, initial analysis has been done with the data to examine the relationship between demographic variables and aspects of environmental justice, community awareness, and the WWTP. Our research will build upon existing research and analyses that have been previously conducted. It is needed to further demonstrate the problem of environmental justice and lack of community awareness in areas that are the most vulnerable to risk associated with the wastewater treatment plant.

*Environmental Justice*

Environmental justice (EJ) is the fair treatment of people regardless of their background with respect to environmental policy and regulation (www.epa.gov). When a community is disproportionately exposed to environmental problems, environmental injustice occurs (Fisher, 2005). These communities are often located near sources of pollution such as near factories or farms.

Environmental injustice affects communities of lower income and higher rates of ethnic minorities. Most power plants, Superfund sites, freeways, storage and disposal facilities, and waste water treatment facilities are located in communities of low socioeconomic status and high percentages of people of color (Petrie, 2006, Stephan, 2005). Low property values, perceived racism, and a least resistant racial class are the believed originators of such occurrences. Furthermore, research indicates that in the late 1980s and early 1990s, more EPA penalties were given to industries where environmental violations threatened white communities. These

penalties, meant to deter environmental and community abuses send messages that a higher value is placed on human health in non-minority communities (Petrie, 2006).

By definition, EJ issues are very dependent on demographic and socioeconomic data. In North Carolina, race and socioeconomic status were found to be related to the exposure of children to toxic air emissions from concentrated animal feeding operations (Mirabelli, 2006). Similarly, the same demographic factors were related to the placement of power plants, wastewater treatment facilities, and hazardous waste sites (Petrie, 2006). EJ issues revolve around different types of problems throughout the country. In California, the location of communities near sources of air pollution is a major problem (Fisher, 2006). Urbanized areas were found to have high levels of toxic emissions. Exposure to minority students was shown to have negative impacts on academic performance (Pastor, Morello-Frosh, & Sadd, 2006). A study conducted in Los Angeles County demonstrated that the citing of toxic substance disposal facilities was negatively related to demographic factors such as race and income (Pastor, Sadd, & Hipp, 2001).

Locally, the Bayview/Hunter's Point neighborhood is a part of San Francisco that has environmental justice issues. This neighborhood's past is filled with industrial and military activity (San Francisco Human Rights Commission (SFHRC), 2003). This will be discussed later in the literature review.

*Community Awareness and its Effects on Involvement*

Community awareness is an important issue for all to address in order for citizens to be active in their communities. Unfortunately, most Americans are uneducated regarding environmental issues and only 15% have read or heard about environmental justice (Wilkins et

al., 1995). Three in four Americans believe pollution producing facilities are more likely to be located in low-income communities regardless of race or ethnicity (Ibid.).

Many scholars have concluded that an improvement in education has a significant impact on the awareness levels of communities (Stephan, 2005; Wilkins et al., 1995; and Sudarmadi et al., 2001). Researchers in Indonesia compared awareness and knowledge rates among two groups of local citizens. The rates for environmental awareness in the educated group were statistically higher than those of the community group (Sudarmadi et al., 2001). Formalized education is important, however even non-formal information dissemination through mass media outlets is crucial to create an environmentally educated citizenry (Ibid). This is true, not only for the international community, but for those living in rural areas and communities with lower incomes who typically may not have access to formalized environmental education.

Community involvement, specifically regarding environmental issues, is the act of like-minded people living within similar geographic regions, forming coalitions for change. It can be exhibited in many forms, including scenarios in which community members attend meetings where elected officials are present and willing to listen to citizen feedback, participate in focus groups, or form political action groups (Stephan, 2005).

Community involvement can also include members taking a proactive and scientific perspective and participating in environmental justice research themselves. Metzger and Lendvay studied the results of a major research project conducted in conjunction with UC San Francisco. Community members of the Bayview Hunters Point area were trained to become scientific researchers collecting and testing water samples from San Francisco's Yosemite Slough. Not only were these community researchers found to contribute greatly to data collection within the actual study, but were also instrumental in the placement of placards in the Yosemite

Slough, warning fishermen about the toxicity of fish in the area. It was found that these community members became leaders in their community, using what they learned to raise awareness among their own people on environmental issues thereby giving them the power to make informed environmental decisions (Metzger and Lendvay, 2006).

There is a reciprocal relationship between public participation and awareness regarding environmental justice issues. Activity increases as citizens become educated about the issues facing them. Trust can be renewed between community members and their local government if agencies become transparent regarding the environmental services they are providing to the community (Ibid). Finally, when community members and leaders are more aware of current issues affecting their community and the policy process, they can make informed decisions and/or become members of the political participatory process.

*Environmental Justice Issues and Awareness Rates*

Communities of high ethnic minority percentages and lower income are far more likely to be the sites of toxic waste facilities, have a higher concentration of factories, and are overexposed to general environmental problems (Petrie, 2006). While most Americans, 56% in 1995, perceive that to be true (Wilkins et al., 1995), those specifically impacted by such issues will have a greater knowledge and appreciation regarding environmental degradation.

Community awareness and involvement are more likely to occur in poorer communities. According to Stephan, such communities become less polarized in blighted conditions and are willing to unite for the common good (Stephan, 2005). Accordingly, communities that are more likely to face and be aware of environmental disparities are also more likely to participate in community action meetings, participate in remediation processes, volunteer to assist scientific

researchers, and begin to take control over their own environmental health (Stephan, 2005; Petrie, 2006; Metzger and Lendvay, 2006).

As mentioned previously, the more educated a community is regarding environmental issues they are facing, the more aware they become regarding environmental and health issues and they are more likely to participate in any remediation processes (Stephan, 2005 and Sudarmadi et al., 2001). Stephan shows a direct correlation between education levels and community awareness-participation.

According to the literature however, race does not play a significant role in community awareness-participation. In a research study conducted by Petrie, she suggests that communities with greater percentages of racial and ethnic minorities are actually less likely to participate in remediation processes. This could be due to a mistrust of big business, agencies such as the Environmental Protection Agency, and the general government (Petrie, 2006). Her work also finds community involvement can decrease the pace and efficiency of environmental cleanup (Ibid.)

It would be interesting to note how wastewater issues in the city of San Francisco are perceived by San Franciscans based on issues such as race, income, and education level. While studies suggest that people with lower income and higher education levels were far more likely to be aware of issues, race may or may not be a significant factor.

*Environmental Racism, San Francisco, and the Wastewater Treatment Plant*

In 2003, city department leaders, community leaders, and members of the general public met in formal workshops with the Human Rights Commission (HRC) to discuss air grievances regarding environmental racism in the Bayview Hunters Point (BVHP) neighborhood.

Environmental Injustice is quite apparent in San Francisco's BVHP neighborhood. According to the 2000 Census, BVHP is a community of over 30,000 persons, 48% of who are African American, 1.3% American Indian, 28% Asian and Pacific Islander, 17% Hispanic and 10% White. Twenty two percent of these families and 22% of individuals exist below the human poverty line. (HRC, 2003). BVHP residents have some of the highest incidences of cancer, asthma, and allergies in the city as well as the state. Not coincidentally, BVHP has the most environmental degradation in the entire city. Within the neighborhood resides:

- A contaminated naval base, including two Superfund Sites
- A polluting power plant
- 100 Brownfield sites
- More than two thirds of the city's 1,263 hazardous waste generators; and
- A sewage treatment plant which handles 80% of the City's wastewater, of all Brisbane's sewage and part of Daly City's sewage (Ibid).

The latter issue was addressed during the HRC's Workshop No. 4. One of the WTP is located in the middle of a residential neighborhood, in the Southeaster part of San Francisco. As mentioned previously, 80% of San Francisco's sewage is treated at this site. That percentage translates to an average of 67 million gallons of sewage per day. This is quite larger than the amount of sewage the Oceanside Treatment Plant (an underground facility located near the zoo) handles. The dry weather average is 21 million gallons per day and during the rainy weather is 65 million gallons per day (HRC, 2003). The Oceanside plant also benefits from odor control technology that filters the air before it is released into the atmosphere.

Southeast residents complain of flooding, insect infestation due to standing water, headaches, noxious odors emanating form the plant and not being able to open windows because of such odors, and decreased property values (HRC, 2003).

During the HRC's meeting, it was determined that in order to start bridging the gap between environmental racism and environmental justice, residents would like to understand the plant's alarm system, to be consulted and informed before changes to public access areas are changed, to be kept informed of progress with the odor problems, and to be informed when other improvements are made (HRC, 2003). Those acknowledgements about the Public Utilities Commission and their Wastewater Treatment Plan also look forward to a promise of odor and flood control measures

*Conclusion*

Environmental racism is the disproportionate occurrence of environmental degradation and environmental abuses usually concentrated in areas where people are of low socioeconomic status and higher minority percentages. Those affected by environmental injustice have higher incidences of illness such as cancer and asthma. Sources of environmental degradation include Superfund sites, the location of industrial plants near residential areas, and in some cases in San Francisco, wastewater treatment plants with an aging infrastructure located in residential areas. Initial research found that education, income, and race are important factors in community awareness -participation, and they are key factors to study when determining who will be aware and participate in the remediation process and who will not. It would be interesting to note how wastewater issues in the City are perceived by San Franciscans based on issues such as race, income, and education level. While studies suggest that people with lower income and higher

education levels were far more likely to be aware of such issues, race may or may not be a significant factor.

*Hypotheses:*

- Community awareness regarding the WWTP will be higher in poorer, minority communities.
- Support for redistribution of sewage treatment will be higher in minority communities.

**Method**

- Research Design

  Our research will use a cross sectional study design. Certain demographic characteristics of respondents, such as race and geographic location, will compared with their responses to questions about environmental justice and the WWTP. This design will be employed because the data focuses on one point in time and will compare respondents' answers regarding the previously mentioned issues.

- Data

Evidence will be collected data, which will be mined from secondary sources. The source of secondary data will be the results of a survey conducted by Dr. Sheldon Gen for the San Francisco Public Utilities Commission. A telephone survey was developed and administered to measure the public's perceptions and preferences with San Francisco's wastewater system. After a list of variables to measure was developed, focus groups were conducted in October 2005 to measure the ranges of responses and not any preferences in language. The survey was translated into two other languages, Spanish and Chinese. The survey concluded on December 31, 2005. 803 households were interviewed. The target population was adults who lived in San Francisco. The sampling frame consisted of residents who lived in San Francisco that were age 18 or older.

Two sampling methods were used: random digit dialing (RDD) and a directory listed household sample. RDD included unlisted phone numbers to ensure accurate representation. Directory listed-household sampling ensured that statistically relevant sample of residents in certain neighborhoods would be obtained. The sample was deployed in 10 segments, which were then divided into three strata representing all of San Francisco; an oversampled census tracts in proximity to the North Point Plant and Southeast Plant. Our unit of analysis will be the individual.

- Variables
  - Independent variable: Demographic characteristics and socioeconomic characteristics
  - Dependent variable: WWTS awareness and environmental justice awareness, as it relates to the WWTS
  - Relationships: It is suspected that environmental justice will be dependent on demographic factors. It is suspected with community awareness will also be dependent on demographic factors.
- Operational measures & scales of measurement (See Attachment 1 for description)

- Data Collection

  Our research will employ the use of secondary data. In December 2005 a telephone survey was administered to 803 households in San Francisco. The instrument consisted of 52 questions. Specific topics included questions about general concerns, rate-payers status, knowledge of the wastewater system, and questions about environmental justice. The target population was adults who lived in San Francisco. The sampling frame

consisted of residents who lived in San Francisco that were age 18 or older. Additionally, we will be using the focus group transcripts from the four focus groups to conduct a content analysis.

- Proposed Analysis

  Some analysis has been conducted under the original study. Our research will consist of multivariate regression analyses, which will examine the combination of demographics, socioeconomics, and geographic location of respondents and the level of awareness of the WWTS and environmental justice. Content analysis will be the secondary method of analysis that will be conducted. Transcripts from the four focus groups used to help create the survey instrument will be analyzed. Statistical analysis will be the primary method of data analysis. We will be using quantitative data derived from the survey. Multivariate analysis will test the relationship of between the dependent and independent variables. The following variables will be combined for analysis. These variables were selected based on "Appendix B: Detailed Survey Report". Their selection was based on which variables were the most significant after bivariate analysis. The independent variables and dependent variables were counted based on the number of times each variable was deemed significant. (See Appendix B for how these variables were coded). The following variables were selected to be combined for analysis:

  *Environmental Justice*

  Independent variables: ethnicity, who pays, language, neighborhood, and whether a respondent rents/owns

  Dependent variables:

  - Who would support redistribution of sewage treatment?
  - Who would support an upgrade even if it increased the sewage bill?

- Who thinks Bayview/Hunter's Point is disproportionately impacted?

*Community Awareness*

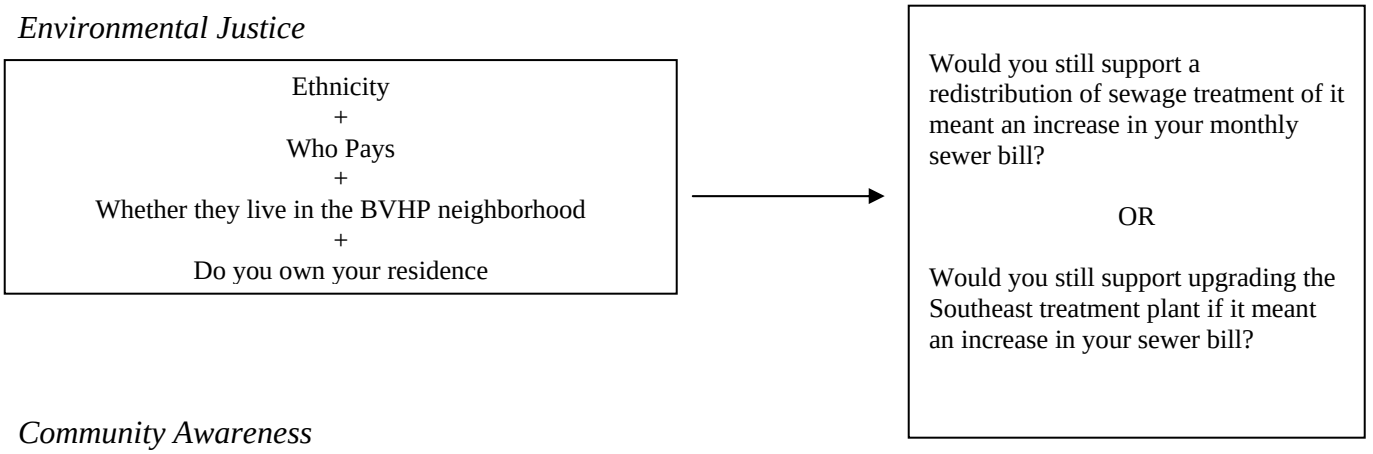
Independent variables: homeowners, education, ethnicity, neighborhood, income

Dependent variables:

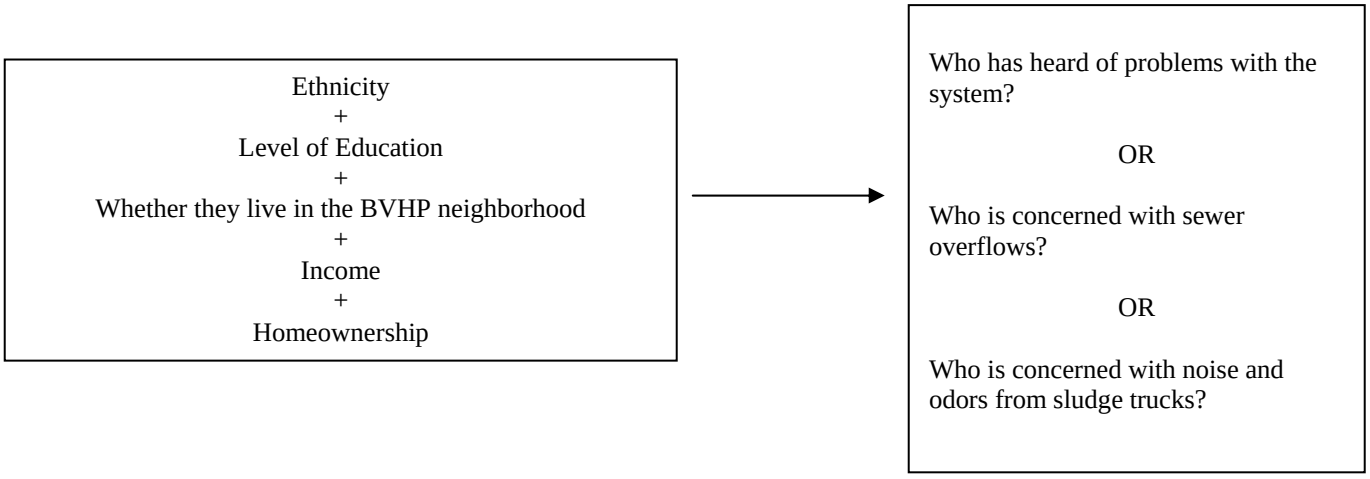
- Who has heard of problems with they system?
- Who is concerned with sewer overflows into the bay and ocean?
- Who is concerned with noise and odors from sludge trucks?

Each of the independent variables will be combined with another and analysis will be conducted with the dependent variable. For example:

*Environmental Justice*




*Community Awareness*



## Results

### Content Analysis: WASTEWATER CHALLENGES FACING SAN FRANCISCO

Awareness among homeowners and renters alike, of wastewater issues in San Francisco was primarily concentrated around price issues and an aging infrastructure. The following table summarizes how focus group members believed the severity of certain water treatment issues.

| | First Choice | Second Choice | Third Choice | Least Choice |
|---|---|---|---|---|
| Aging and deteriorating pipes and equipment | Westside Homeowners, Renters, Southeast residents | Eastside Homeowners | | |
| Bad odors from wastewater facilities | | Southeast Residents | | Westside homeowners, Eastside homeowners, Renters |
| Sewage discharges and overflows into the Bay and Ocean during major rainstorms | Eastside homeowners | Southeast residents, Renters, Westside homeowners | | |
| Flooding | | | Southeast residents | Westside homeowners, Eastside homeowners, Renters |
| Lack of a place to dispose of treated solid waste after current disposal agreements end in 2006 | | Westside homeowners, Eastside homeowners, Renters | Southeast residents | |
| Impacts of existing wastewater treatment plants on surrounding neighborhoods | Southeast Residents | | | Westside homeowners, Eastside homeowners, Renters |
| Risks from earthquakes and other disasters | Eastside homeowners, Renters | Westside homeowners, Renters | Southeast residents, Renters | |

Among Westside homeowners, finances were particularly crucial. All groups felt that the cost of treating the water was too high and bond funds approved by voters are wasted. For those

living near the Southeast Plant itself, definite problems were shared regarding the way water is handled in terms of the quality of the aging infrastructure. Old pipes that were seemingly always being replaced were another area of concern were mentioned in some form by all focus group sessions. One astute observer even mentioned that the very fact they were assembled in a room discussing wastewater issues indicated that there was a problem.

Similarly, most respondents agreed that sewage discharges were a large problem. This toxic leakage into the Bay and ocean was a concern for each focus group. While most respondents rated foul odor emissions as a low priority; Southeast residents definitely disagreed by ranking this category as their second highest area of concern. Not so surprisingly, Southeast residents also rated impacts on surrounding neighborhoods as their first and primary area of concern, while all other respondents felt that problem was one of least concern.

Respondents overwhelmingly ranked these issues according to their residential status. For example, both Westside and Eastside homeowners believed strict odor controls were in place and stated that since odor problems did not affect them, they could not comment on the issue. One Westside respondent even went as far as to say that odors can be controlled and that if people have problems with foul smells, they should not go to the area or "take another route".

When asked about odor problems and *complaints* from local residents, the renter focused group replied that since anyone could make a complaint, a high percentage of a particular neighborhood would have to be available before the issue would be taken seriously. Every renter respondent said they would be concerned with such issues even if the complaints were in a distant neighborhood.

Three of the Eastside homeowner focus group heard of environmental justice and two of them offered an accurate definition. One Westside homeowner was aware of the term, but could

not define it. Two people in the renter focus group were aware of the term but could not give a definition. Three of the Southeast focus group respondents heard of it, but only one could give an accurate definition. Other responses included a literal definition of environmental justice; that is justice for the environment and biosphere.

When asked if San Francisco was accurately addressing environmental justice issues most respondents in the Eastside focus group agree that disparities are not being addressed and that certain neighborhoods are being adversely affected. One respondent knew of specific health and environmental concerns in the area and was, “thankful to get out alive” when leaving his position in the Southeast Post Office. There was a general consensus that these issues were political and driven by constituent funding. Finally, one respondent voiced an opinion that the Southeast plant may be there for practical reasons, and not necessarily due to environmental justice issues. Six respondents then agreed. Practicality was a common thread for the Westside homeowner and Renter focus groups as well. The Southeast area of the city was an industrial dump long before it became a neighborhood of lower-income African Americans and immigrants. Some respondents had trouble with the concept of the city having forethought for the area to be low income due to the amount of industry there. One renter refused to believe that those types of things could happen in San Francisco.

Eastside respondents agreed that wastewater is not distributed equally throughout the city, but only four expressed concerns over the inequality. The remaining respondents showed no concern because they are not directly impacted by the plant and recognize the importance of water treatment. Westside homeowners did not feel there is a distribution problem, because there are no adverse impacts other than foul odors which can be controlled. Most renters agreed that

while there is a wastewater distribution problem, upgrading the Southeast plant would be a better solution than distributing the waste equally.

Southeast resident respondents however, definitely saw environmental justice as a real issue and agreed standards are not being met in San Francisco. The rising health concerns, incidences of childhood asthma and cancer are of chief concern. These respondents were also aware that most of the city's sewage is treated at their plant. When told environmental justice was not general knowledge or a major concern for other focus groups around the city, Southeast respondents were not surprised due to the fact that there are so many other issues people are concerned with and talk about. One respondent is quoted as saying, "I think the Bayview Hunters Point is getting the shaft on a lot of issues, and I think water is one of them."

These results are not surprising, but in some instances disturbing. The fact that most homeowners in the focus group did not care or show concern over the inequality issues was alarming. Apparently, one is not worried with something one has no relationship with.

**Statistical Analysis**

*Environmental Justice*

A regression analysis compared four independent variables against two dependent variables. (See Appendix C for all statistical tables). Ethnicity, whether a resident rent or owns, who pays the sewer bill, and neighborhood were the independent variables that were compared.

When asked whether respondents would support a redistribution of sewage treatment if it meant an increase in their sewer bill, responses varied based on the independent variables. Those who paid the sewer bill, lived in the BVHP neighborhood, and Black decreased support if it meant an increase in their sewer bill. Variables that demonstrated a statistically significant

relationship [1] with this question were respondents who were Black or Asian and owned their residence.

Similarly, when asked whether respondents would still support upgrading the Southeast treatment plant if it meant an increase in their sewer bill, responses were mixed. All ethnicities and those who pay the sewer bill decreased their support if it meant an increase in their bill. Variables that demonstrated a statistically significant relationship [2] with this question were respondents who were White or Black and owned their residence.

*Community Awareness*

A regression analysis compared six independent variables against three different dependent variables.[3]

The first analysis looked at respondent feelings towards sewage overflows into the Bay and ocean. Respondents who were Black, homeowners, middle income, low income, and those who were highly educated indicated a negative concern over sewage overflows. However the only relationships that were significant were those among Asians (indicated positive units of concern), homeowners, and higher educated respondents.

The next equation looked at level of concern with noise and odor from sludge trucks. Units of concern decreased amongst Black and Asian respondents, those who paid the sewer bill and those who were Southeast residents. Significant results were found amongst Whites, those who own their homes, and those who have a college education. All of these groups indicated positive units of concern over this variable.

[1] Tested at a 95% confidence level.
[2] Tested at a 95% confidence level.
[3] Tested at a 95% confidence level.

The third and final variable equation looked at general awareness of problems with the city's sewer system. Those who pay the sewer bill and all income levels showed positive units of awareness regarding any problems. All other groups showed a negative level of awareness. Statistically significant findings were all variables except those living in the Southeast community and those in the lower income variable. Those living in the Southeast neighborhood had a non-significant decrease in concern and those categorized in the lower income variable had a non-significant increase in concern.

**Discussion and Conclusion**

While some concern is expressed over the disproportionate exposure of residents in the BVHP neighborhood to the wastewater treatment plant, residents of San Francisco are still hesitant to support any redistribution or upgrades to the Southeast plant if it means an increase in their sewer bill. This can be explicitly seen in the regression analysis and the focus groups. Residents who own their homes were sensitive to changes to the treatment plant if it resulted in an increase in their sewer bill and claimed that renters and tenants should also bear an increase in the bill. When asked about support for redistribution of sewage treatment, support decreased by Blacks, those who paid for some or all of the sewer bill, and those in the Southeast neighborhood. Surprisingly, support also decreased for upgrading the Southeast plant for all minorities. When asked about supporting upgrades in the system residents who paid for some or all of the bill had the same complaint with increase in the bill.

Overall, while environmental injustice regarding the Southeast treatment plant is acknowledged and some are willing to support upgrades and redistribution, whether one pays for some or all of the sewer bill turns out to be better indicator of changes, especially if changes mean an increase in the sewer bill.

Awareness regarding problems with the city's treatment plant was found with those who owned their homes and all income levels indicated a relationship between finances and awareness. Surprisingly, those in the Southeast area were found to be less aware, indicating problems with the Southeast plant may not be as apparent as previously thought. This contrasts sharply with the focus group results in which most Southeast respondents knew of problems with the system. The lack of concern among Blacks and Southeast residents for both sewage overflows and noise and odors from sewage trucks was surprising. The decrease of concern could be indicative of problems not being as serious as first thought. Another explanation could be what a focus group participant mentioned; that there is just too much going on. Residents surveyed who live in a neighborhood so economically and physically distressed, which includes some of the most dangerous streets in the city, might simply have more on their minds than sewage.

In general, those respondents in the lower income scale showed concern over noise and odors, and awareness of treatment facility problems. This could be indicative of problems affecting them more often or the fact that they become more aware of where the little money they have goes. We can not say our hypothesis for minority awareness is supported because our results were not significant. Our hypothesis for income level and awareness however can be supported due to marginal significance.

Our findings indicate that environmental justice is an issue within the city of San Francisco. Most residents surveyed showed some level of concern over wastewater distribution, but the "Not in My Back Yard" phenomenon, dulled the concern for those who would be most financially affected. Our findings support the hypothesis that those in lower income brackets will be more aware and show more concern over waste water treatment issues. However, EJ and

awareness relationships amongst local minorities and Southeast residents could not support our hypothesis. Explanations include the sampling frame, limitations in our methods, or the fact that those located in the BVHP area may have more concern and awareness over the other many environmental stresses they face in their daily lives.

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# ATTACHMENT 1

| Variables | Relevant Question | Operational Measure | Scale of Measurement |
|---|---|---|---|
| **Dependent** | | | |
| Environmental Justice | 23, 24 | knowledge of term | nominal |
| | 25 | determination of whether standards are met (based on definition | nominal |
| | 26, 27, 28 | impact of WTP on neighborhoods | nominal |
| | 29 | Oceanside plant and EJ | nominal |
| | 30, 31 | support of redistribution | nominal |
| | 32,33 | support of upgrade | nominal |
| Community Awareness | | | |
| | 17 | Who has heard of problems | |
| | 19 | Direct problems | |
| | 20 a-k | Concern with odors, sludge, overflows, flooding, potholes, damage, capacity, cost of treatment, disruption of services | |
| | 21 a-k | Who thinks aging of pipes, odors, flooding, potholes, sludge, noise, sewage, capacity problems are LIKELY | |
| | 22a | Pollution in Bay important | |
| | 22b | Public health | |
| | 22c | Federal Fine | |
| **Independent Variables** | | | |
| Demographics | 2, 3, 4, 5 | ratepayer status | nominal |
| | 42 | income | ratio |
| | 43 | level of education | nominal |
| | 45 | ethnic background | nomnial |
| | 49, 50, 51 | where you live | nominal |

## APPENDIX A – Variable Definitions

Variables were collapsed in order to create bivariate variables to be used in the regression analysis.

**Ethnicity:** We were interested in respondents of White, Black and Asian ethnicity responses to questions. Therefore we created 3 new variables: White, Black, and Asian. Each ethnicity was then compared to respondents whose selected Native American, Hispanic and other.

**Neighborhood:** We were interested in differences in responses between those who live in the Bayview Hunter's Point neighborhood and those who don't. A new variable was created to account for those who live in the 94124 neighborhood and those who don't.

**Who Pays the Sewer Bill:** A new variable was created to account for those who pay for some or all of their bill and those who don't.

**Do you own your residence:** A new variable was created to account for those who own their residence and those who do not.

**Income:** A primary focus was income level and community awareness. A new variable was created to indicate those in a lower income bracket (Below 50,000), middle income (50,000 – 149,999), and high income (150,000 and above)

**Education:** Finally we were interested in how education levels influenced people's opinions. A new variable was created to account for two different education levels; High School or Below and Some College or Higher.

## Appendix B – Regression Analysis Results

**Would you still support upgrading the SE treatment plant if it meant an increase in your sewer bill?** Significant variables ($\alpha$ <.05) where White, Black and Own.

While controlling for Blacks & Asians, Whites support upgrading the SE treatment plant decreases by 0.253, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

While controlling for Whites & Asians, Blacks support upgrading the SE treatment plant decreases by 0.466, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

While controlling for Blacks & Whites, Asians support upgrading the SE treatment plant decreases by 0.069, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

Compared to those who don't pay for some or all of their sewer bill, those who pay some or all of the sewer bill decreases their support for upgrading the SE treatment plant by 0.066 if it meant an increase in their sewer bill.

Compared to those who don't live in the Bayview Hunter's Point Neighborhood, those who do live in the 94124 area code increase their support for upgrading the SE treatment plant by 0.051 if it meant an increase in their sewer bill.

Compared to those who don't own their residence, those who own their residence increase their support for upgrading the SE treatment plant by 0.32 if it meant an increase in their sewer bill.

**Would you still support a redistribution of sewage treatment if it mean an increase in your sewer bill?** Significant variables ($\alpha$ <.05) where Black, Asian and Own.

While controlling for Blacks & Asians, Whites support for redistribution of sewage treatment increases by 0.133, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

While controlling for Whites & Asians, Blacks support for redistribution of sewage treatment decreases by 0.390, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

While controlling for Blacks & Whites, Asians support for redistribution of sewage treatment increases by 0.277, considering who pays the sewer bill, whether they live in the Bayview Hunter's Point Neighborhood, and whether they own their residence.

Compared to those who don't pay for some or all of their sewer bill, those who pay some or all of the sewer bill decreases their support for redistribution of sewage treatment by 0.055 if it meant an increase in their sewer bill.

Compared to those who don't live in the Bayview Hunter's Point Neighborhood, those who do live in the 94124 area code decrease their support for redistribution of sewage treatment by 0.003 if it meant an increase in their sewer bill.

Compared to those who don't own their residence, those who own their residence increase their support for redistribution of sewage treatment by 0.259 if it meant an increase in their sewer bill.

**Have you heard about any problems with the City's sewer system in the past 5 years?** *Significant variables ($\alpha$ <.05) were White, Black, Asian, Pays, Own, College, High income, Middle income. Marginally significant: Low income*

Compared to the Hispanic reference group, Whites had a .248 decrease for every unit of awareness while holding Black, Asian, Pays, Own, Southeast, College, High income, Middle Income, and Low income constant

Compared to the Hispanic reference group, Blacks had a .202 decrease for every unit of awareness while holding White, Asian, Pays, Own, College, Southeast, High income, Middle Income, and Low income constant

Compared to the Hispanic reference group, Asians had a .189 decrease for every unit of awareness while holding Black, White, Pays, Own, Southeast, College, High income, Middle Income, and Low income constant

Compared to those who do not pay most or all of their sewer bill, those who do had an increase of .130 in awareness while holding White, Black, Asian, Own, Southeast, College, High income, Middle Income, and Low income constant

Compared to those who do not own their own homes, those who do had a .249 decrease for every unit of awareness while holding White, Black, Asian, Pays, Southeast, College, High income, Middle Income, and Low income constant

Compared to those who do not have a college education, those who do had a decrease of .223 for every unit of awareness while holding White, Black, Asian, Pays, Southeast, Owns, High income, Middle Income, and Low income constant

Compared to those who do not have a high income, those who do had a .210 increase for every unit of awareness while holding White, Black, Asian, Own, Pays, College, Southeast, Middle Income, and Low income constant

Compared to those who do not have a middle income, those who do had a .202 increase for every unit of awareness while holding White, Black, Asian, Own, Southeast, Pays, College, High income, and Low income constant

Compared to those who do not have a low income, those who do had a .094 increase for every unit of awareness while holding White, Black, Asian, Southeast, Own, Pays, College, and High income constant

**How concerned are you with noise and odors from trucks that dispose of treated sludge?** *Significant variables ($\alpha$ <.05) were White, Own, and College. Marginally Significant: High Income*

Compared to the Hispanic reference group, Whites show a .416 increase for every increase in concern while holding White, Black, Asian, Southeast, Own, Pays, College, and High income constant

Compared to those who do not own their own homes, those who do had a .188 increase for every increase in concern while holding White, Black, Asian, Pays, College, Southeast, High, Middle, and Low income constant

Compared to those who do not have a college education, those who do had a .230 increase for every increase in concern while holding White, Black, Asian, Pays, Owns, Southeast, High, Middle, and Low income constant

Compared to those who do not have a high income, those who do had a .253 increase for every increase in concern while holding White, Black, Asian, Pays, College, Owns, Southeast, Middle, and Low income constant

**How concerned are you with sewage overflows into the Bay and ocean?** *Significant variables ($\alpha$ .05) were Asian and College. Marginally significant: Own*

Compared to the Hispanic reference group, Asians has a .355 increase for every increase in concern while holding White, Black, Pays, College, Southeast, Owns, Middle, and Low income constant

Compared to those who do not have a college education, those who do had a -.451 decrease for every increase in concern while holding White, Black, Asian, Pays, Owns, Southeast, Middle, and Low income constant

Compared to those who do not own their own homes, those who do had a .128 decrease for every increase in concern while holding White, Black, Asian, Pays, College, Southeast, Middle, and Low income constant

# Appendix C – Regression Analysis Tables

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 47.115 | 10 | 4.711 | 9.707 | .000[a] |
| | Residual | 359.780 | 741 | .485 | | |
| | Total | 406.895 | 751 | | | |

a. Predictors: (Constant), Low Income, Black, SewerBill, Southeast, Asia Income, College and Above, ownresidence, White, Middle Income

b. Dependent Variable: Sewage overflows into the Bay and ocean durin rainstorms

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.789 | .103 | | 17.396 | .000 |
| | White | .110 | .070 | .075 | 1.568 | .117 |
| | Black | -.094 | .114 | -.033 | -.822 | .411 |
| | Asian | .355 | .077 | .210 | 4.595 | .000 |
| | SewerBill | .117 | .065 | .079 | 1.789 | .074 |
| | Southeast | .047 | .145 | .012 | .324 | .746 |
| | ownresidence | -.128 | .069 | -.087 | -1.862 | .063 |
| | College and Abov | -.451 | .075 | -.243 | -6.045 | .000 |
| | High Income | .037 | .104 | .016 | .358 | .720 |
| | Middle Income | -.045 | .080 | -.030 | -.566 | .572 |
| | Low Income | -.054 | .083 | -.035 | -.646 | .518 |

a. Dependent Variable: Sewage overflows into the Bay and ocean during major rair

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regressior | 87.712 | 10 | 8.771 | 10.646 | .000[a] |
| | Residual | 589.295 | 715 | .824 | | |
| | Total | 677.007 | 725 | | | |

a. Predictors: (Constant), Low Income, Black, SewerBill, Southeast, H Asian, College and Above, ownresidence, White, Middle Income

b. Dependent Variable: Noise and odors from trucks that dispose of tr

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.680 | .135 | | 12.474 | .000 |
| | White | .416 | .092 | .215 | 4.506 | .000 |
| | Black | -.170 | .149 | -.046 | -1.145 | .252 |
| | Asian | -.113 | .103 | -.051 | -1.104 | .270 |
| | SewerBill | -.020 | .085 | -.010 | -.235 | .814 |
| | Southeast | -.234 | .197 | -.043 | -1.187 | .236 |
| | ownresidence | .188 | .089 | .097 | 2.112 | .035 |
| | College and Above | .230 | .098 | .095 | 2.343 | .019 |
| | High Income | .253 | .137 | .082 | 1.847 | .065 |
| | Middle Income | .081 | .106 | .041 | .768 | .443 |
| | Low Income | .062 | .108 | .031 | .572 | .567 |

a. Dependent Variable: Noise and odors from trucks that dispose of treated sludge

**ANOVA[b]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 21.792 | 10 | 2.179 | 10.364 | .000[a] |
| | Residual | 150.509 | 716 | .210 | | |
| | Total | 172.301 | 726 | | | |

a. Predictors: (Constant), Low Income, Black, SewerBill, Southeast, Asian, Hi Income, College and Above, ownresidence, White, Middle Income

b. Dependent Variable: Have you heard about any problems with the City's se system in the past 5 years?

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 1.912 | .066 | | 29.173 | .000 |
| | White | -.248 | .047 | -.254 | -5.260 | .000 |
| | Black | -.202 | .075 | -.108 | -2.679 | .008 |
| | Asian | -.189 | .052 | -.165 | -3.621 | .000 |
| | SewerBill | .130 | .043 | .133 | 3.000 | .003 |
| | Southeast | -.090 | .095 | -.034 | -.947 | .344 |
| | ownresidence | -.249 | .045 | -.255 | -5.496 | .000 |
| | College and Abov | -.223 | .050 | -.180 | -4.458 | .000 |
| | High Income | .210 | .069 | .135 | 3.028 | .003 |
| | Middle Income | .202 | .054 | .201 | 3.755 | .000 |
| | Low Income | .094 | .054 | .093 | 1.734 | .083 |

a. Dependent Variable: Have you heard about any problems with the City's sewer sy the past 5 years?