Agua y Salud: Water Quality & Environmental Health Community Study

Imperial County, California

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California State University SAN MARCOS

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EXECUTIVE SUMMARY

Approximately 3,835 households living in the rural agricultural zone (ag-zone) of Imperial County (IC) use canal water at home (IID, 2010). Imperial Irrigation District (IID) warns the public that water "provided by IID is untreated canal water and not suitable for cooking and drinking purposes" (IID Website). Therefore, IID requires residents living in ag-zones to secure a "safe alternative water supply" for drinking and cooking from an approved provider to comply with the California Safe Drinking Water Act.

> The quality of drinking water is critical to our health.
>
> (United States Environmental Protection Agency)

This report, ***Agua y Salud: Water Quality & Environmental Health in Imperial County, California*** summarizes findings of a collaborative pilot community study between the National Latino Research Center (NLRC) and Comite Civico del Valle (CCV) designed to gauge water quality issues and community awareness of environmental hazards in Imperial County's ag-zone. Findings suggest residents living in ag-zones possess general awareness of environmental contaminants in their surrounding but are less knowledgeable of water quality issues and how water contaminants affect their health. Study outcomes suggest water contamination is a prevalent silent health risk affecting thousands of individuals in Imperial County today.

The study assessed extent of water contamination in households residing near canals to gain a better understanding of the barriers rural communities face accessing safe water for residential purposes. The study utilized Geographical Information System (GIS) to identify and select participants. A Pre-Post Test research design was used to evaluate environmental health awareness and knowledge. The Pre-Test included a baseline survey of health and environmental pollution knowledge.

FIGURE 1: INCREASING ACCESS TO WATER PURIFICATION SYSTEM

For the treatment, NLRC developed a popular educational intervention or "teaching guide" focused on water quality and environmental health. Utilizing the effective community outreach *promotores model*, NLRC/CCV worked with promotores to teach residents 1) how to test water quality levels in their homes, 2) how to reduce household pesticide use, 3) about potential adverse health effects of exposures to environmental hazards, 4) how to limit or minimize exposure, and 5) how to become more civically engaged in the community to improve prevalent environmental health and justice issues. The Post-Test included a survey to test awareness and knowledge gained during the intervention. To incentivize cooperation with the study and reduce attrition, participants who completed the study received a

water purification system providing access to safe drinking water in their homes. All study participants were invited to attend the Environmental Health Leadership Summit (EHLS) in November 2011 and NLRC presented the findings of the study to the general public during the EHLS.

The study enrolled 35 randomly selected households with a connection to water canals in ag-zones who consented to participate in the study. A summary of significant findings is included in table below:

AREA	SURVEY FINDINGS
Water Quality	88.5% of participant households pay their water bill directly to IID.
	6 out of 35 (14%) of participant households tested positive for water contaminants (i.e. pesticides - nitrates, nitrites, atrazine, and simazine) from kitchen faucet.
	25 out of 35 (70%) of participant households tested positive for pathogens in water (i.e. coliform bacteria).
Community Awareness of Resources	51.7% of participants lack awareness of IID's REAP program.
	21.4% of participants are enrolled in IID's REAP program.
Community Awareness of Health Risks	Over 80% of participants agree or strongly agree that pesticides are poison.
	Over 88% of participants agree or strongly agree that pesticides cause negative health effects.
	Over 94% of participants agree or strongly agree that they have the right to safe drinking water.
	Over 90% of participants agree or strongly agree that pollution is found in soil, water, and air.
	Over 90% of participants agree or strongly agree that pollution harms people and the environment.
	Over 90% of participants agree or strongly agree that safe, clean water is essential for healthy living.
Civic Engagement & Political Awareness	40% of participants have never volunteered at church.
	64% of participants have never helped clean up their neighborhood.
	70% of participants have never volunteered with a community-based organization.
	97% of participants have never volunteered in a political campaign.
	68% of participants have never helped to raise funds for a social cause.
	60% of participants have never used the internet to explore local social issues.
	60% of participants have never studied U.S. history or civics.
	40% of participants have never learned about constitutional or civic rights.
	54% of participants have never studied the history of Latinos in the United States.
	34% of participants are a little or not all familiar with elections and the voting process in the United States.
Environmental Awareness	50% of participants stated that they are a little or not at all familiar with the environmental status of Imperial County.
	56% of participants stated that they are a little or not at all familiar with water quality issues in Imperial County.

Enhanced and strategic collaboration among local, state, federal agencies and community organizations is necessary to address water quality issues Imperial County confronts today. Although the majority of residents in ag-zones might be familiar with environmental exposures and health risks, the general public can benefit from increased outreach and education customized to reach residents in ag-zones who use canal water. Additionally, provision of greater incentives and support programs and services to increase access to safe drinking water quality for residents who face economic barriers will benefit the community at large. Limited political awareness of political and legislative processes contribute to low levels of political participation and civic engagement in Imperial County.

INTRODUCTION

Poor water quality negatively impacts the overall health and quality of life of Imperial County residents. The problem is especially critical in agricultural zones (ag-zones) where residents are exposed to untreated water from irrigation canals at home.

A marker indicating the location of a "Pipe" that leads to a residence. Typically, a "Pipe" stems from IID managed canal that leads to a cistern and a residential water pump which pressurizes the residence's water supply. This is commonly referred to as the "Intake system."

The number of households connected to water canals varies by year. On average 3,884 households have been connected to water canals during the last five years (IID). IID is a "public agency whose mission it is to provide reliable, efficient and affordably priced water and energy service to the communities it serves" (IID website, 2011). With more than 3,000 miles of canals and drains, IID is the largest irrigation district in the nation (IID website, 2012). These canals provide water to residents who live in the county's ag-zones also referred to as the countryside. However, IID warns the public that water delivered to households in the "countryside" is not safe for drinking. Hence, IID water users who receive canal water at their homes or businesses must have an alternate source of water for drinking and cooking purposes (IID website, 2012). IID instructs residents to complete a "Certificate of Ownership and Authorization of Agent or Tenant" and submit a signed "IID Water Supply Agreement" detailing requirements for receiving water from an approved source including D&M Water Company, Roman's Water, El Oasis Water Company, Yosemite Waters, and Sparkletts/Crystal Water (IID website, 2012).

Chlorinated tablets used in conjunction with the residence's water pump that distributes well water to the home.

Despite IID's established requirements for residents in ag-zones to provide their own safe water, NLRC/CCV found that many residents, particularly renters, encounter difficulties accessing safe water and are devising alternative strategies to secure

"safe" water. Some residents use chlorinated tablets along with their pumps in order to disinfect the canal water, prior to residential usage. Other residents have installed advanced intake systems, which include advanced filtration systems that are accompanied with ultraviolent (UV) water purification lights used to kill microorganisms such as bacteria, viruses, and molds. However, all intake systems require maintenance which can be costly and burdensome especially for very low income families.

View looking at 1966 irrigation canal with thick, brown foam on the surface of the water. This canal supplies three residences with water.

In the first round of water sampling, 27 out of 35 household water samples in the study tested positive for either coli form bacteria or pesticides, which indicates that the majority of the homes do not have a safe, proper intake system, or cannot afford the system's maintenance.

The majority of the participants reported using chlorinated tablets in conjunction with their residential water pumps, or more commonly pouring bleach into their home's cistern, due to low cost and availability. Many of the project's participants stated that they could not afford chlorinated tablets or the proper maintenance for their home's water intake system. The majority of residents reported that even though they are aware of the laws and regulations, they are hesitant to call authorities and report water-related complaints for fear of being forced to repair an intake system or simply being evicted by landlords.

Agricultural burning happens regularly contributing to Imperial County's poor air quality.

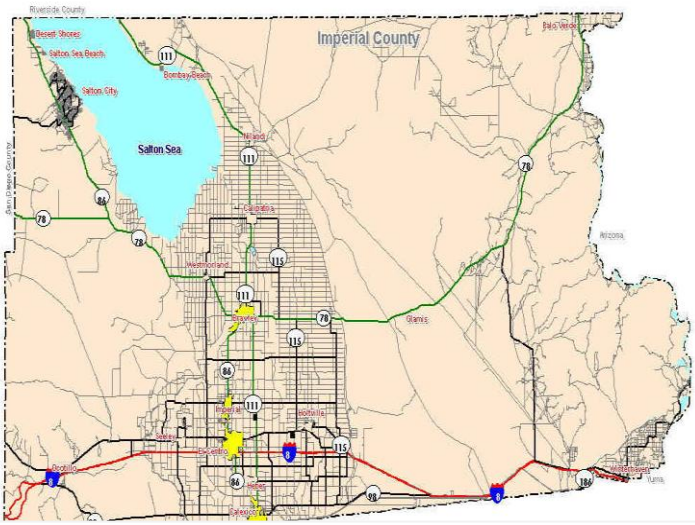
Imperial County residents are exposed to a multitude of environmental hazards on a regular basis. The Imperial-Mexicali border region suffers from some of the worst particulate matter air pollution problems in California, with some locations measuring more than ten times the maximum allowable federal standard (U.S. EPA). Sources of air pollution include particulate matter released from vehicles, geothermal power plants, agricultural burning, pesticide use, and factories. In addition to air pollution, Imperial County showcases several notorious cases of water pollution with the Alamo River and the New River, two rivers which flow northward from Mexico and drain into the Salton Sea (RWQCB, Region 7).

PROFILE OF IMPERIAL COUNTY'S AGRICULTURAL ZONE

This section provides a demographic profile of Imperial County's Agricultural Zone and highlights important characteristics that make this region unique and an important contributor to the nation's food supply.

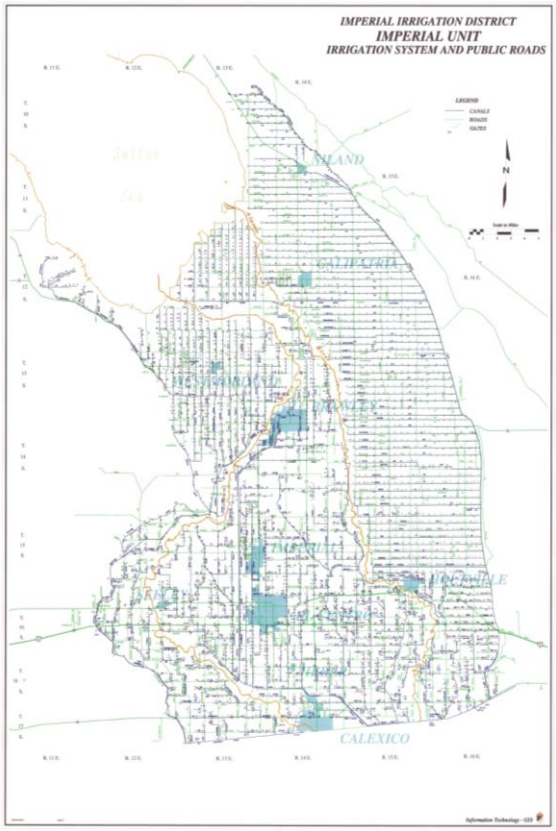
Imperial County is located in the southeast corner of the state of California and extends over 4,597 square miles with the Salton Sea and Riverside County to the north, San Diego County to the west, Arizona to the east and Mexico to the south. The Imperial County rural agricultural zone is often referred to by local residents as the "Countryside."

FIGURE 2: MAP OF IMPERIAL COUNTY



Source: www.co.imperial.ca.us.MapCounty.htm

FIGURE 3: IRRIGATION CANALS



Imperial County is primarily an agricultural community with 529,334 acres harvested with a total gross agricultural value of over $1.5 billion in 2010 (IC Agriculture Commissioners' Office, 2011). IID is Imperial County's water supplier, serving a total gross acreage within district boundaries of 1,061,637 (IID, 2010). IID diverts and delivers approximately 3.1 million acre-feet (MAF) of Colorado River water to nine cities and maintains 10 fully operational reservoirs in Imperial County. IID does not own or operate municipal water treatment facilities and was initially created to provide irrigation to the agricultural industry.

Although there is a common understanding among residents in Imperial County that no one is supposed to drink the water sourced from the canals in the countryside, NLRC/CCV learned that many families do not have the economic means to secure water from approved providers nor can they afford to purchase bottled water for all their household needs. Additionally,

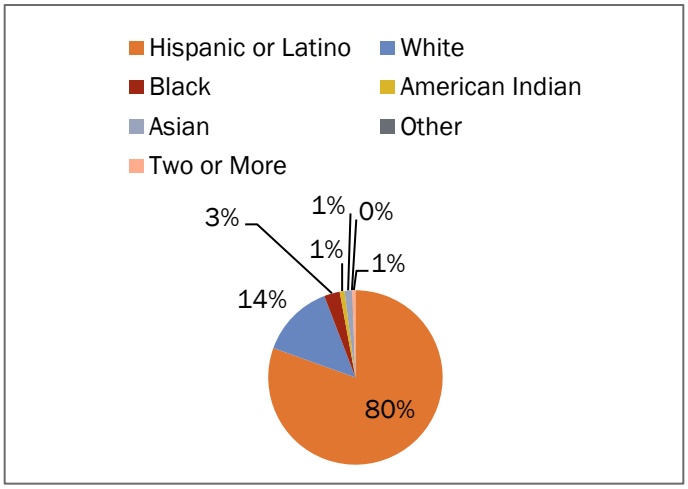
many families are resorting to cheap sugary beverages or sodas in lieu of bottled water. Residents typically purchase their drinking water from local water vending machines that are commonly located in shopping centers or outside of convenience stores. According to the California Department of Public Health, retail water facility and water vending machine operators are required to test their water for coli form bacteria at least once every 6 months. If purified water is dispensed, dissolved solids must be measured not less frequently than once every 7 days (CDPH, 2011). However, water quality tests results are not readily posted on vending machines. Consumer can call the California Department of Public Health phone number listed on the vending machines and request the most recent water sampling results for each individual vending machine. The information is available upon request in Spanish and English.

Families are using contaminated water for common household needs such as bathing, dishwashing, cleaning, cooking, and gardening and are therefore being exposed to health hazards. Coli form bacteria's dermal exposure can produce skin rashes and eye, ear or throat irritation from direct contact. Children, the elderly, and those with compromised immune systems are the most vulnerable to this form of exposure.

Demographic Information of Imperial County

According to the 2010 U.S. Census, Imperial County has a population of 174,528 with the largest concentration in the cities of El Centro with a population of 42,598, followed by Calexico with 38,572, and Brawley with 24,953 people. The remaining population lives in unincorporated rural areas in the midst of vast agricultural fields, highways, country roads, and a network of irrigation canals consisting of more than 1,438 miles of lateral canals, 230 miles of main canals (IID, 2010).

Figure 4: Imperial County Population By Race



Source: U.S. Census Bureau, 2010

Approximately 140,271 or 80.4 percent of the population consider themselves Hispanic or Latino (U.S. Census Bureau, American FactFinder, 2010). The majority of Hispanics/Latinos (77.2 percent) are of Mexican origin (U.S. Census Bureau, 2006-2010 American Community Survey 5-Year Estimates, 2010).

Although Imperial County's population is growing, it is still a sparsely populated region facing serious challenges. Nineteen percent of families live below the poverty level and in August 2011 Imperial County reported 32 percent unemployment, the highest unemployment rate in California (EDD 2011). Over 20 percent of adults have less than 9th grade education (U.S. Census Bureau, 2006-2010 American Community Survey 5-Year Estimates, 2010).

In Imperial County, of the population 25 years and older, 23 percent are high school graduates and 12 percent have bachelor's degree or higher. Over 73 percent of the population speaks a language other than English at home, and 71 percent of them speak Spanish (U.S. Census Bureau 2010). Thirty-three percent (56,950) of persons living in Imperial County are 19 years of age or younger and 10 percent of persons living in Imperial County are 65 years of age or older (U.S. Census Bureau, American FactFinder, 2010).

The health of Imperial County residents ranks low compared to other counties in California. According to the County Health Ranking study of the Robert Wood Johnson Foundation, Imperial County health outcomes rank 35 of 56 in the state of California, 25/56 in premature death, 47/56 in morbidity, 52/56 in health factors, 49/56 in clinical care, 43/56 in physical environment and 56/56 in social and economic factors. A summary of health outcomes is provided below:

TABLE 1: IMPERIAL COUNTY HEALTH RANKING

	Imperial County	National Benchmark*	California	Trend	Rank (of 56)	Error Margin
Health Outcomes					35	
Mortality					25	
Premature death	6,568	5,466	5,922			6,149-6,987
Morbidity					47	
Poor or fair health	31%	10%	19%			25-37%
Poor physical health days	4.8	2.6	3.7			3.7-5.9
Poor mental health days	3.8	2.3	3.6			2.8-4.9
Low birthweight	6.10%	6.00%	6.70%			5.8-6.4%
Health Factors					52	
Health Behaviors					28	
Adult smoking	11%	14%	14%			8-16%
Adult obesity	25%	25%	24%			20-30%
Physical inactivity	23%	21%	18%			18-28%
Excessive drinking	14%	8%	17%			10-21%
Motor vehicle crash death rate	20	12	12			17-23
Sexually transmitted infections	423	84	399			
Teen birth rate	66	22	40			64-69
Clinical Care					49	
Uninsured	24%	11%	20%			22-26%
Primary care physicians	2,398:1	631:01:00	847:01:00			
Preventable hospital stays	57	49	52			53-61
Diabetic screening	84%	89%	79%			80-87%
Mammography screening	54%	74%	63%			50-58%
Social & Economic Factors					56	
High school graduation	79%		74%			

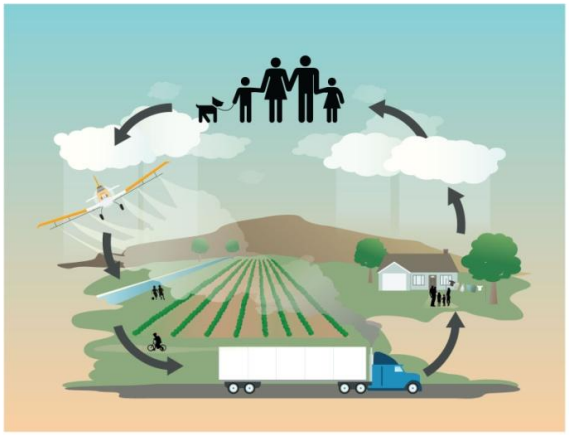
Some college	46%	68%	60%			44-49%
Unemployment	29.70%	5.40%	12.40%			
Children in poverty	32%	13%	22%			26-38%
Inadequate social support	24%	14%	25%			18-31%
Children in single-parent households	35%	20%	30%			32-38%
Violent crime rate	327	73	500			
Physical Environment					43	
Air pollution-particulate matter days	5	0	16			
Air pollution-ozone days	33	0	51			
Access to recreational facilities	5	16	9			
Limited access to healthy foods	14%	0%	5%			
Fast food restaurants	47%	25%	49%			
Source: http://www.countyhealthrankings.org/print/county/snapshots/2012/06/025						

Popular Education: Explaining Environmental Health Disparities

Explaining the science of environmental health to community health educators who in turn educate community residents is a critical step in improving community health. The role of community health educators is especially critical in low income and underserved communities like Imperial County.

Over the past decade the prevalence of environmental pollution-related health disparities among individuals living and working in agricultural zones has continued to rise despite better understanding among the scientific community of the effects of exposure to toxins such as pesticides, heavy metals, fungicides, and per chlorate (NIEHS: National Institutes of Health. 2009).

Figure 5: Community Exposures to Environmental Hazards

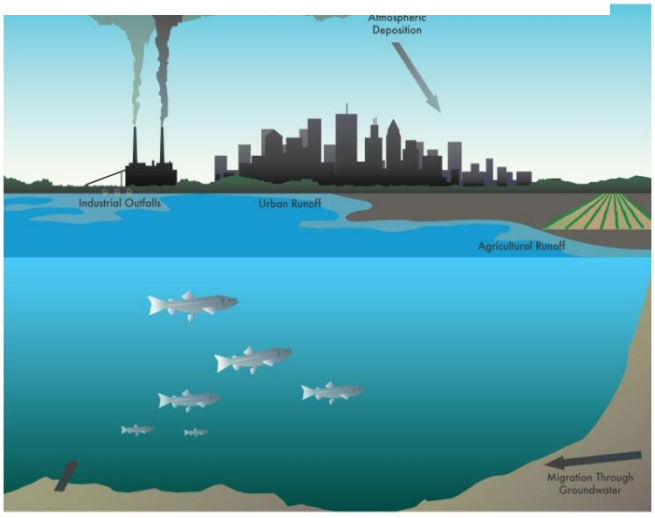


Source: NLRC Designs by Demitri Hidalgo

Health Implications

Exposure to environmental pollution is a significant risk factor for the toxicity (or deficits in) the cellular, reproductive, developmental, neurological, and nervous systems (Poppel & Clark 2003, and Eskenazi 1999). Evidence suggests that long-term exposure to low-levels of pesticides, or a mixture of pesticides can cause a wide range of symptoms in humans ranging from skin irritation, headaches, vomiting, insomnia, and coma, to carcinogenesis, tumor promotion, diabetes, intestinal disorders, seizures, Parkinson's disease, paralysis, and death (Poppel & Clark 2003, and Eskenazi 1999). However, the most affected and vulnerable populations often have the least access to critical information they need in order to protect themselves and their families.

Figure 6: Education to Build Healthy Community



Sources of Contamination

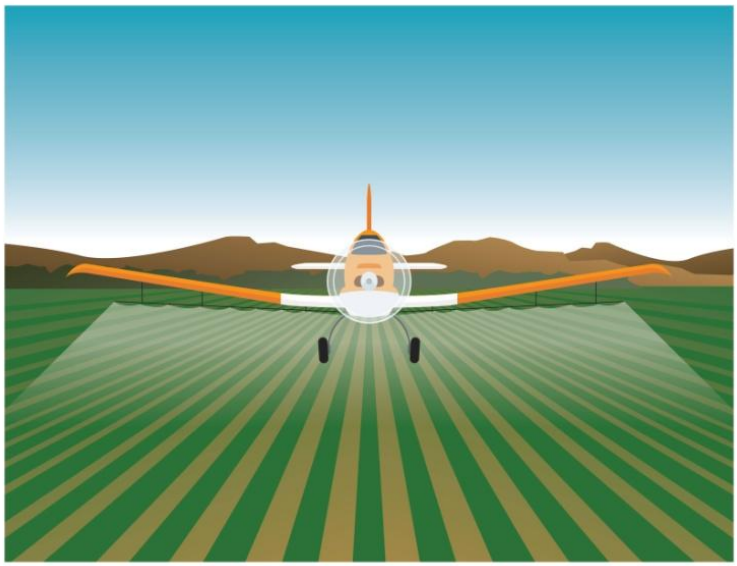
In an effort to reach affected families and deliver effective education to help them minimize exposure to environmental hazards, NLRC developed a tailored environmental health education guide in English and Spanish for Imperial County's population. The teaching guide explains environmental health concepts and terminology using community-based experiences and examples that are immediate and relevant to the population. For example, to explain sources of air pollution, NLRC employed examples such as agricultural burning, exhaust from vehicles at the Calexico-Mexicali border crossing, power plants, unpaved roads, and agricultural burnings which take place on a regular basis.

FIGURE 7: AGRICULTURAL BURNING

Source: NLRC Photo Gallery

According to English et al., (1998) particulate matter levels are typically four times higher in Imperial County than in San Diego County. Among California children, Imperial County has the highest percentages of one or more chronic health conditions in California, and asthma is the most commonly diagnosed chronic health condition (*"Chronic Health Conditions of Californians" 2010*). The alarming asthma rates are primarily due to poor air quality. In addition to particulate matter, Imperial County households in the "Country" may be exposed to aerial spraying of pesticides as a result of off-target contamination, called pesticide drift. Pesticide drift contaminates water canals, soil, and directly affects people's health.

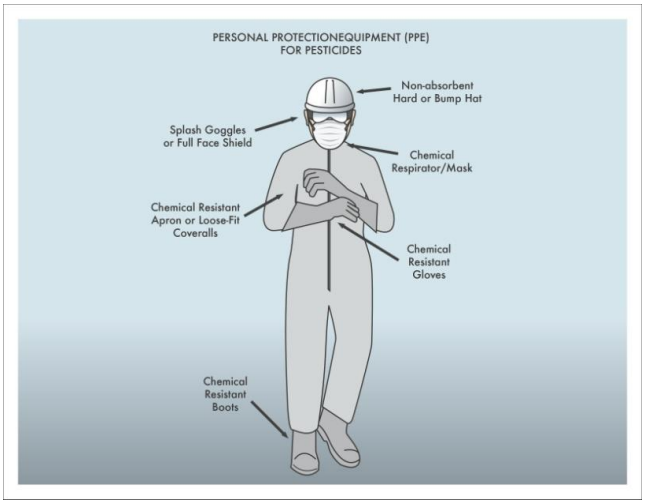
FIGURE 8: PESTICIDE DRIFT



Source: NLRC Designs by Demitri Hidalgo

The teaching guide describes pesticides by discussing insecticides, herbicides, fungicides, and rodenticides. According to the U.S. Environmental Protection Agency, "Pests are living organisms that occur where they are not wanted or that cause damage to crops or humans or other animals" (EPA, 2011). Community education emphasized potential exposure and how pesticides enter one's body or routes of exposure. Considering that many of the "Country's" residents are connected to farming industry and work directly in agriculture, often handling pesticides regularly, the education plan addressed safety precautions individuals can take to reduce exposure such as the use of personal protective equipment (PPE) and methods for preventing outdoor pollution from entering their homes.

FIGURE 9: PERSONAL PROTECTION



Source: NLRC Designs by Demitri Hidalgo

The teaching guide describes water pollution by discussing groundwater contamination, urban and agricultural runoff. Groundwater is contaminated from seepage through landfills, failed septic tanks, leaking underground (fuel) storage tanks, industrial and residential pesticides and fertilizers. Once groundwater is contaminated, it is unsafe to drink or to use for preparing food, for bathing, or for irrigation. Cleaning groundwater once it has been contaminated is very costly.

The agricultural zone of Imperial County is especially vulnerable to agricultural runoff, or non point source pollution, due to IID's network of irrigation canals. The teaching guide describes federal water regulations, such as the Safe Drinking Water Act, which is intended to protect the public by regulating the public water supply, to provide a better understanding of how government regulates environmental exposures on behalf of public health. Lastly, the teaching guide describes how individuals and families can become more proactive in safeguarding their own health at home by increasing awareness regarding the toxicity of commonly used pesticides and household cleaning chemicals and shared alternatives that are less harmful and non toxic. The teaching guide defines the concept of toxicity as the degree to which a substance can harm humans or animals, emphasizing the fact that toxicity of substances affects all living things including microorganisms, plants, animals, and humans. The effects of toxic substances are unhealthy to all living beings.

FIGURE 10: SAFE CLEANING PRODUCTS

Source: NLRC Designs by Demitri Hidalgo

BUILDING EVIDENCE FOR COMMUNITY EMPOWERMENT

Working in collaboration with community health workers or promotores, NLRC identified and collected Global Positioning System (GPS) coordinates that were utilized to create Geographical Information Systems (GIS) maps in order to map environmental and socio-economic indicators from 35 randomly selected participants in specific geographic areas who consented to participate in the study. Promotores worked in pairs and visited each selected household, introducing themselves, and asking residents if they were willing to participate in the study. Once a willing participant was identified, the promotores described the study in detail and explained consent forms to secure voluntary participation. Promotores read each consent form, asked if participants had questions and asked appropriate person to sign the consent. Once participants consented to participate in the study, they completed enrollment questionnaires and including demographic information and a pretest to assess awareness and knowledge related to environmental health and exposures.

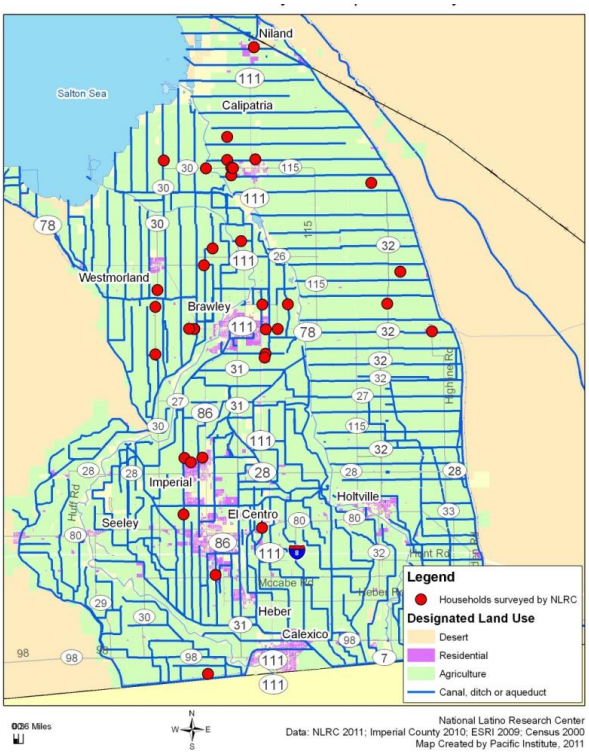
Participants agreed to conduct water sampling utilizing a PurTest® Home Water Analysis Kit to detect various water conditions and contaminants, including lead, pesticides, and bacteria. Once a water sample was collected and analyzed, promotores shared the results with the participant and discussed questions or concerns associated with the results. Promotores conducted two to three home visits to each residential household, each visit taking approximately 60 minutes to deliver educational trainings on environmental pollution and water contamination. At the conclusion of the study, all participants received a water filtration system for their household use as an incentive for their participation in the study. Overall data collection aimed to identify level of community awareness and education and the need for improved access to safe drinking water through water quality assessment and environmental pollution education. Additionally, promotores provided participants with educational materials and information related to help them access the following available programs and resources:

- IID's Residential Energy Assistance Program (REAP) describing guidelines and eligibility criteria.
- Imperial County Authority Contacts List for participants to contact local agencies and organizations if they had questions about water quality. NLRC composed a community resource list designed to identify and describe government agencies by jurisdiction. The list includes public, local, and state agencies, along with elected officials involved in public health and environmental regulation.
- Print resources explaining the health effects associated with each condition and contaminant assessed by the PurTest® Home Water Analysis Kit.
- At the conclusion of the project's data collection, participants received a reverse osmosis home water filtration system. The water filtration system specifically targeted the water contaminants and conditions identified during data collection.

Summary of Findings

Thirty-five households participated in the study. Six out of 35 household water samples tested positive for pesticides and 25 out of 35 household water samples tested positive for bacteria.

FIGURE 11: MAP OF HOUSEHOLDS SURVEYED IN AG-ZONES



Participant Demographics

As Table 2 shows, 66% of study participants were born outside the United States, including Mexico and Central American countries. Consistent with county demographics, the majority of participants are Hispanic or Latino, and over 48% declared Spanish is the primary language among the participating households. Thirty-nine percent of participants stated that English is their primary language of communication, and 13% reported that they are bilingual English/Spanish. This finding calls attention to the importance of creating and disseminating information and educational materials in a bilingual format and the importance of considering cultural competency since the majority of the population is Spanish-speaking and are of Mexican origin.

TABLE 2: PARTICIPANT DEMOGRAPHIC CHARACTERISTICS

Country of birth	U.S. Mexico Central America	34.3% 62.9% 2.9%	N=35
Primary language used to communicate with employer	English Spanish Both	38.7% 48.4% 12.9%	N=31
Primary language used to communicate with friends and family	English Spanish Both	25.7% 54.3% 20.0%	N=35

As shown in Table 3, more than 70% of the participating households have, at least, one or more children living in a household, and about 40% of the participating families reported that they live with more than 3 adults. 60% of the participating families live in single-family homes while 37.1% live in mobile homes. These families tend to have lived in their current homes for a relatively long time: 83.9% have lived there over 3 years, and only 6.5% families recently moved into current residence.

Table 3: Household Characteristics			
Number of adults living in a household	7 5 4 3 2 1	2.9% 2.9% 14.7% 17.6% 50.0% 11.8%	N=34
Number of children living in a household	6 5 4 3 2 1 0	2.9% 2.9% 8.6% 14.3% 17.1% 20.0% 34.3%	N=35
Types of home	Single-family home Mobile home Other	60.0% 37.1% 2.9%	N=35
Number of years living in current home	Over 3 years 2-3 years 1-2 years 0-1 year	83.9% 6.5% 3.2% 6.5%	N=31

Water Sampling Results

Certified researchers collected water samples from 35 participant households twice - in October 2010 (1st test) and March/April 2011 (2nd test). Tables 4 and 5 show the results of the water analysis. Average acidity (pH) among 35 water samples was slightly higher at the 1st test (8.11 pH) than at the 2nd test (7.65 pH), but the difference is not statistically significant, implying that the average of both alkalinity and acidity was constant. In any case, both alkalinity and acidity are at a neutral level. On the other hand, water hardness — the degree of excess minerals in the water — significantly increased from 181.66 ppm (1st test) to 262.74 ppm (2nd test). The reason for this significant increase in water hardness is unknown. The average of water hardness among these 35 water samples (181.66 ppm and 262.74 ppm) is

Table 4: Water Quality Results				
		1st test (October 2010)	2nd test (March/April 2011)	
		%	%	
Alkalinity (mEq/L)	240 180 120 80	25.7% 40.0% 34.3% 0.0%	3.2% 77.4% 16.1% 3.2%	N=35
	Mean	174.86 mEg/L	169.03 mEg/L	
PH (pH)	9.0 8.0 7.0 6.0 0.0	57.1% 22.9% 11.4% 5.7% 2.9%	16.1% 32.3% 51.6% 0.0% 0.0%	N=35
	Mean	8.11 pH	7.65 pH	
Total Hardness (ppm)	445.0 425.0 250.0 120.0 50.0 25.0 15.0 3.0 0.0	2.9% 34.3% 2.9% 2.9% 5.7% 28.6% 17.1% 2.9% 2.9%	0.0% 29.0% 51.6% 6.5% 3.2% 0.0% 6.5% 0.0% 3.2%	N=35
	Mean	181.66 ppm	262.74 ppm	

*There is no statistically significant difference between measures at the 1st test and 2nd test, except the water hardness. The average ppm increased from 181.66 ppm to 262.74 ppm, and this is statistically significant.

very high, and more than 80% of household water samples tested over 250.0 ppm, indicating an extremely high rate of water hardness. Water hardness may not have a direct health effect on the residents in this area; however, water hardness may cause damage on a home's plumbing system and/or water-using appliances.

Table 5 shows the results of additional water analysis both at the 1st and 2nd tests. Again, any changes (increase and reduction) in this analysis are not statistically significant, meaning that the water analysis results are consistent over a period of time. Over 70% of household water samples tested positive for bacteria both at the 1st and 2nd tests. At the 1st test, about 15% of household water samples tested positive for atrazine and simazine, main components of pesticide, and 3% of household water samples tested positive for lead.

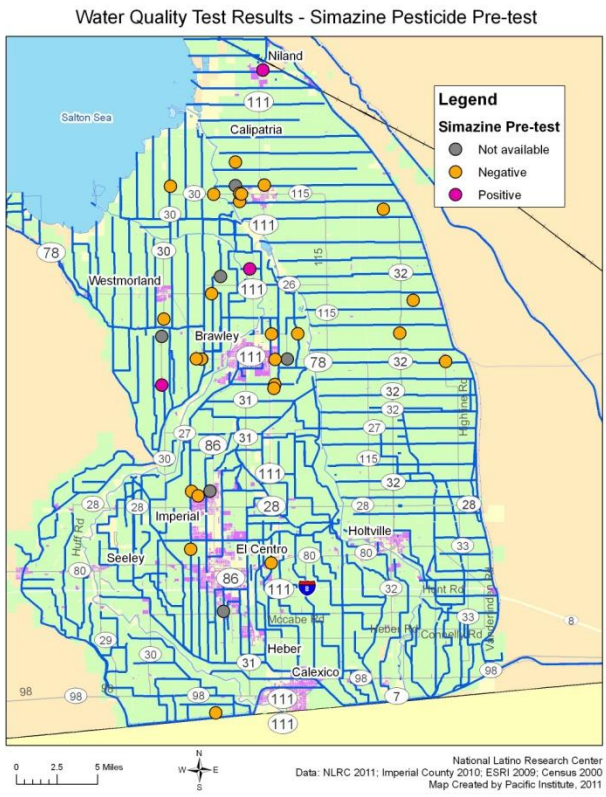
TABLE 5: WATER QUALITY RESULTS

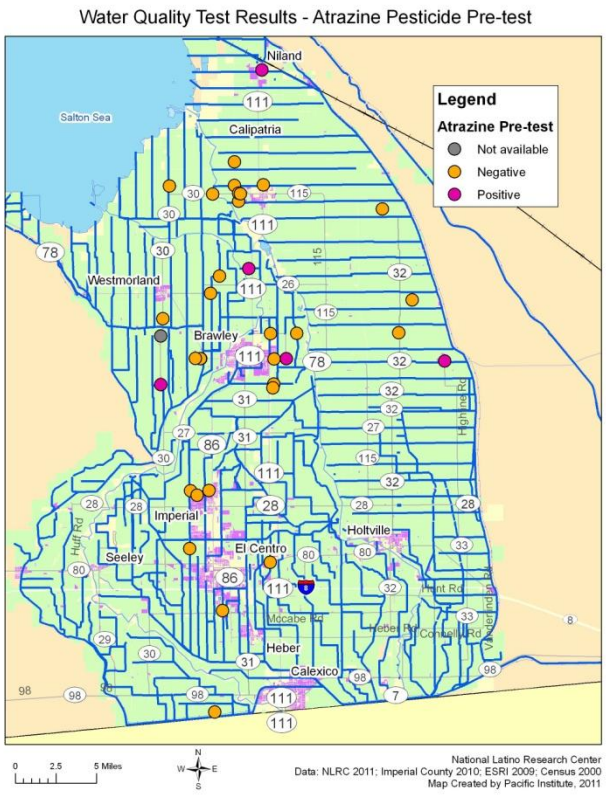
	1st test (October 2010) N=35		2nd test (March/April 2011) N=31	
		%		%
Nitrates	Safe	100.0%	Safe	100.0%
	Unsafe	0.0%	Unsafe	0.0%
Nitrites	Safe	97.1%	Safe	100.0%
	Unsafe	2.9%	Unsafe	0.0%
Bacteria	Positive	70.6%	Positive	70.0%
	Negative	29.4%	Negative	30.0%
Atrazine	Positive	14.7%	Positive	3.2%
	Negative	85.3%	Negative	96.8%
Simazine	Positive	11.1%	Positive	3.2%
	Negative	88.9%	Negative	96.8%
Lead	Positive	2.9%	Positive	3.2%
	Negative	94.3%	Negative	93.8%

*There is no statistically significant difference between measures at time 1 and time 2 in terms of the existence of these compounds, meaning that these compounds consistently exist in the water sampled at two different times.

These findings suggest that coliform bacteria is relatively common and a serious problem among these households regardless of other influential factors such as type of housing, length of residence, etc., and their potable water is polluted with bacteria and a variety of chemicals. On overview of the geographic distribution of positive tests is provided below.

TABLE 6: WATER QUALITY RESULTS BY GEOGRAPHY





To verify initial sampling results, NLRC researchers collected 7 water samples from kitchen faucets from randomly selected participant homes and sent the samples to Enviromatrix Analytical, Inc., a laboratory in San Diego, California that is in compliance with local, state, and federal regulatory requirements. The purpose of the additional sampling and analysis was to establish a more detailed understanding of contaminants. Analysis found that 5 out of 7 households tested positive for e-coli bacteria. At one particular home, the water sample detected 866 e-coli colonies per 100 ml. According to the US EPA's National Primary Drinking Water Regulations, the maximum contaminant level (MCL) for e-coli bacteria is **zero** mg/L.

A variety of human illness have been linked to contaminants found in our water sampling. A brief overview of the contanminants, maximum contamination level, maximum contaminant level goal, health effects and sources of contamination is provided in Table 7 below.

TABLE 7: HEALTH EFFECTS OF WATER CONTAMINANTS

Contaminant	Maximum Contaminant Level (MCL)	Maximum Contaminant Level Goal (MCLG)	Health Effects	Sources of Contamination
NITRATES	10 milligrams per Liter (mg/L) or 10 parts per million (ppm)	10 mg/L or 10 ppm	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill, and if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits.
NITRITES	1 milligram per Liter (mg/L) or 1 part per million (ppm)	1 mg/L or 1 ppm	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill, and if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits.
ATRAZINE	0.003 milligrams per Liter (mg/L) or 3 parts per billion (ppb)	0.003 mg/L or 3 ppb	Some people who drink water containing atrazine in excess of the MCL over many years could experience problems with their cardiovascular system or reproductive difficulties.	Runoff from herbicide used on row crops.
SIMAZINE	0.004 milligrams per Liter (mg/L) or 4 parts per billion (ppb)	0.004 mg/L or 4 ppb	Some people who drink water containing simazine in excess of the MCL over many years could experience problems with their blood.	Herbicide runoff
LEAD	in parts per million (ppm) Lead = 0.015 ppm	0 ppm	Delays in physical or mental development; children could show slight deficits in attention span and learning abilities. **Adults:** Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits.

Source: U.S. EPA 2012, http://water.epa.gov/drink/contaminants/basicinformation/index.cfm

As mentioned earlier, residents in this area have lived at current residence for longer than three years and therefore have been exposed to contaminants for multiple years.

Community Resources and Awareness

To secure safe drinking water, countryside residents are supposed to secure water on their own from an approved provider. However, NLRC/CCV found that families use canal water for household purposes and are challenged to secure safe drinking water. Table 8 shows that more than 90% of households pay for their water, either to Imperial Irrigation District (IID) or landlord directly. 51.7% of the study population reported that they did not know about IID's Residential Energy Assistance Program (REAP), the program subsidizes energy bills for the elderly and low income families. After in-depth research, NLRC discovered that the program also subsidizes drinking water for eligible homes within Imperial County's Agricultural Zone. However, the water assistance is not commonly known. The REAP program was set up to comply with the California Safe Drinking Water Act (SDWA) between IID and the State of California's Department of Health Services. According to IID the agreement, the vast majority of the canal water users reported having an "alternative water" source (Imperial Irrigation District's SDWA Compliance Project, 2005-2009). The REAP program consists of a $15 monthly drinking water subsidy in the form of credit on the utility bill. Low income families that qualify for REAP must contract one of five drinking water companies in Imperial County and have potable water delivered to their home. Moreover, if a family qualifies for REAP; the family will receive a monthly 15 percent discount on their electric bill and IID will provide compact fluorescent light bulbs to the residence and an energy audit, which is intended to reduce a household's energy consumption and decrease energy costs (IID).

TABLE 8: SOURCES OF WATER & IID'S REAP PROGRAM

Who do you pay your water bill to?	Landlord IID City Other	3.8% 88.5% 3.8% 3.8%	N=26
Has IID or your landlord provided information about water quality?	Yes No	43.3% 56.7%	N=30
Do you know about IID's REAP program?	Yes No	48.3% 51.7%	N=29
Are you currently enrolled in IID's REAP program?	Yes No	21.4% 78.6%%	N=28

Though families are generally aware of the poor water quality in their homes; however, they hesitate to express concerns or to contact landlord and/or authorities for fear of retribution. Participants' main concern is the high cost of installing filtration systems and purchasing water delivery from approved sources due to affordability. Participants who rent from their landlords are especially worried of eviction if they make demands of their landlords. Hence, it appears that in addition to community education, families face institutional and structural issues at different levels in their efforts to access safe water.

Health & Environmental Risk Awareness

We included a set of attitudinal questions measuring participants' awareness of health risk and rights to safe drinking water in pre-post surveys (scale is ranging from Strongly agree=1, Agree=2, Disagree=3 to Strongly disagree=4). As shown in

Table 9, the project teaching guide effectively increased participants' awareness of pesticides' long-term effects. Nonetheless, as participants already demonstrated very high level of knowledge at the initial test, further statistically significant effect of the project teaching guide was not detected.

TABLE 9: HEALTH RISK AWARENESS

		Time 1 (Pre-test)	Time 2 (Post-test)	
		%	%	
All pesticides are poison	Strongly agree	54.3%	51.9%	N=31
	Agree	25.7%	32.3%	
	Disagree	20.0%	12.9%	
	Strongly disagree	0.0%	3.2%	
	Mean	1.66	1.68	
It's safe to breath pesticides	Strongly agree	11.8%	6.5%	N=31
	Agree	11.8%	0.0%	
	Disagree	32.4%	32.3%	
	Strongly disagree	44.1%	61.3%	
	Mean	3.09	3.48	
Only people who work the fields are affected by pesticides	Strongly agree	17.6%	12.9%	N=31
	Agree	2.9%	0.0%	
	Disagree	26.5%	35.5%	
	Strongly disagree	52.9%	51.6%	
	Mean	3.15	3.39	
Pesticides cause negative health effects	Strongly agree	64.7%	58.1%	N=31
	Agree	23.5%	35.5%	
	Disagree	8.8%	6.5%	
	Strongly disagree	2.9%	0.0%	
	Mean	1.50	1.48	
By law, I have the rights to safe drinking water	Strongly agree	79.4%	64.5%	N=31
	Agree	14.7%	35.5%	
	Disagree	2.9%	0.0%	
	Strongly disagree	2.9%	0.0%	
	Mean	1.29	1.35	
Using Products like Fabuloso, bleach, pinesol or chlorine is safe and not related to health	Strongly agree	17.6%	0.0%	N=31
	Agree	26.5%	32.3%	
	Disagree	29.4%	38.7%	
	Strongly disagree	26.5%	29.0%	
	Mean	2.65	2.97	
Pesticides are only found in the soil	Strongly agree	3.0%	3.2%	N=31
	Agree	9.1%	3.2%	
	Disagree	24.2%	45.2%	
	Strongly disagree	63.6%	48.4%	
	Mean	3.48	3.39	
Pesticides are only found outside my house	Strongly agree	14.7%	6.5%	N=31
	Agree	14.7%	3.2%	
	Disagree	23.5%	45.2%	
	Strongly disagree	47.1%	45.2%	
	Mean	3.03	3.29	
Exposure to pesticides will only affect me in the short-term NOT long-term	Strongly agree	26.5%	3.2%	N=31
	Agree	5.9%	3.2%	
	Disagree	20.6%	41.9%	
	Strongly disagree	47.1%	51.6%	
	Mean	2.88	3.42**	

*Mean score is based on a scale: Strongly agree=1, Agree=2, Disagree=3 and Strongly disagree=4
**Changes in mean scores between pre- and post-tests were not statistically significant with an exception.

More than 80% of the respondents reported that they know pesticides are poison and can cause negative health effects. The majority also know that not only people who work on the field but also people who reside in this area can be affected. Furthermore, about 70% of the households believe that pesticides are found outdoors/indoors and know that pesticides are found in the soil, air, and water. This demonstrates respondents' relatively high awareness of the health risk of being exposed to pesticides and the fact that they are exposed to pesticides in their daily lives. Before participating in this project, 32.5% believed that exposure to pesticides only had short-term effects; however, the rate was successfully reduced to 6% at the post-test.

TABLE 10: HEALTH RISK AWARENESS

	Frequency	%	
Pollution is found in soil, water and air	Strongly agree Agree Disagree Strongly disagree	53.3% 36.7% 3.3% 6.7%	N=30 Mean=1.63 SD=0.85
Pollution harms people and the environment	Strongly agree Agree Disagree Strongly disagree	56.7% 40.0% 0.0% 3.3%	N=30 Mean=1.50 SD=0.68
Children and elderly are the most vulnerable to pollution	Strongly agree Agree Disagree Strongly disagree	56.7% 40.0% 0.0% 3.3%	N=30 Mean=1.67 SD=0.96
Safe, clean water is essential for healthy living	Strongly agree Agree Disagree Strongly disagree	64.5% 25.8% 3.2% 6.5%	N=31 Mean=1.52 SD=0.85
Contaminated water is harmful to the body	Strongly agree Agree Disagree Strongly disagree	61.3% 32.3% 3.2% 3.2%	N=31 Mean=1.48 SD=0.72
I have access to safe drinking water	Strongly agree Agree Disagree Strongly disagree	33.3% 50.0% 6.7% 10.0%	N=30 Mean=1.93 SD=0.91
Indoor pollution can trigger an asthma attack	Strongly agree Agree Disagree Strongly disagree	46.7% 46.7% 3.3% 3.3%	N=30 Mean=1.63 SD=0.72
*Mean score is based on a scale: Strongly agree=1, Agree=2, Disagree=3 and Strongly disagree=4			

Almost 100% of the study participants agree both at the pre- and post-test that they have the rights to safe drinking water (see Table 6) and about 80% reported having access to safe drinking water at the post-test (see Table 7). Participants generally know the health risk of being exposed to pesticides/pollution found in soil, water and air but less than 20% believe their potable water may be contaminated.

Civic Engagement and Knowledge of Environmental Issues

Study participants are vulnerable due to nationality, culture, language, socio-economic class, and age. As shown in Table 11 and Table 12, the degree of civic engagement among the participants is very low: 97.1% have never volunteered in a political campaign; 69.7% have never volunteered in a community organization; 63.7% have never helped clean up their neighborhood; 67.6% have never helped to raise funds for a social cause; 60% have never studied history of the U.S.; and 65% were born in other countries.

TABLE 11: CIVIC ENGAGEMENT

I do the following activities . . .	Frequency	%	
Volunteer at church	Often Sometimes Never	20.6% 38.2% 40.0%	N=34 Mean=2.01 SD=0.77
Help clean up my neighborhood	Often Sometimes Never	15.2% 21.2% 63.65	N=33 Mean=2.25 SD=0.76
Read the newspaper or magazines	Often Sometimes Never	44.1% 32.4% 23.5%	N=34 Mean=1.79 SD=0.81
Volunteer in a community organization	Often Sometimes Never	12.1% 15.2% 69.7%	N=33 Mean=2.64 SD=0.74
Volunteer in a political campaign	Often Sometimes Never	2.9% 0.0% 97.1%	N=33 Mean=2.97 SD=0.39
Help to raise funds for a social cause	Often Sometimes Never	5.9% 26.5% 67.6%	N=34 Mean=2.62 SD=0.60
Use the Internet to explore local social issues	Often Sometimes Never	20.0% 20.0% 60.0%	N=35 Mean=2.40 SD=0.81
Study civics and history of the U.S.	Often Sometimes Never	8.6% 31.4% 60.0%	N=35 Mean=2.51 SD=0.66
Learn about my constitutional and civil rights	Often Sometimes Never	28.6% 31.4% 40.0%	N=35 Mean=2.11 SD=0.83
Study the history of Mexican/Chicanos in the U.S.	Often Sometimes Never	17.1% 28.6% 54.3%	N=35 Mean=2.37 SD=0.77
*Mean score is based on a scale: Often=1, Sometimes=2 and Never=3			

Table 11 shows levels of awareness of Imperial County's environmental status, water quality and pesticide usage, political decision-making/voting process, current local politics, laws and how to get involved in advocacy efforts.

TABLE 12: POLITICAL AWARENESS		
I know about . . .	Frequency	%
The cultural history of my community	A lot	17.1%
	Some	25.7%
	A little	28.6%
	Not at all	28.6%
	Mean	2.69
Government and laws	A lot	20.6
	Some	32.4%
	A little	26.5%
	Not at all	20.6%
	Mean	2.47
Ways to volunteer in my community	A lot	14.3%
	Some	45.7%
	A little	17.1%
	Not at all	22.9%
	Mean	2.49
Who are my elected government officials	A lot	6.1%
	Some	33.3%
	A little	12.1%
	Not at all	48.5%
	Mean	3.03
Environmental status of Imperial County	A lot	20.6%
	Some	29.4%
	A little	23.5%
	Not at all	26.5%
	Mean	2.56
The voting process	A lot	27.3%
	Some	36.4%
	A little	8.6%
	Not at all	25.7%
	Mean	2.36
Water quality in Imperial County	A lot	23.5%
	Some	20.6%
	A little	14.7%
	Not at all	41.2%
	Mean	2.74
Pesticide use in Imperial County	A lot	35.3%
	Some	38.2%
	A little	8.8%
	Not at all	17.6%
	Mean	2.09

Enhanced and strategic collaboration among local, state, federal agencies and community organizations is necessary to address water quality issues Imperial County confronts today. Although the majority of residents in ag-zones might be familiar with environmental exposures and health risks, the general public can benefit from increased outreach and education customized to reach residents in ag-zones who use canal water. Additionally, provision of greater incentives and support programs and services to increase access to safe drinking water quality for residents who face economic barriers will benefit the community at large. Limited political awareness of political and legislative processes contribute to low levels of political participation and civic engagement in Imperial County.

RECOMMENDATION

In an effort to protect the health of Imperial County residents who use canal water in their homes, NLRC recommends increasing access to safe drinking water for all residents, particularly canal water users who lack resources to provide water for their families. The effort to improve infrastructure to deliver safe drinking water necessitates enhanced collaboration across agencies and community-based organizations and access to financial resources. Additionally, more substantial incentives are needed for residents who encounter difficulties accessing safe drinking water due to cost. Most importatly, coordinated efforts to enhance infrastructure development to deliver safe drinking water to all Imperial County residents necessitate funding and multi-agency coordination and collaboration.

Contact Information

For more information about this report, please contact the National Latino Research Center at Cal State San Marcos by calling 760.750.3500, emailing nlrc@csusm.edu, or visiting the website at www.csusm.edu/nlrc

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