



King County Dirt Alert 2015 Survey Report Summary

Background

For almost 100 years, a company called Asarco operated a copper smelter in Tacoma. Air pollution from the smelter settled on the surface soil over a large region - more than 1,000 square miles of the Puget Sound basin. Even though the smelter closed in 1986, arsenic, lead and other heavy metals are still in the soil as a result of this pollution. Studies have found soil contamination in parts of King, Pierce, Kitsap, and Thurston counties. This area is called the Tacoma Smelter Plume. King County Dirt Alert (KCDA) is a program at Public Health–Seattle & King County (PHSKC) funded by the Washington State Department of Ecology (Ecology).

Purpose of Survey

The goal was to measure awareness of soil contamination and behaviors people take to reduce contact with soil. It also looked at sources of information and attitudes that can help us develop outreach and education strategies.

Summary of Findings

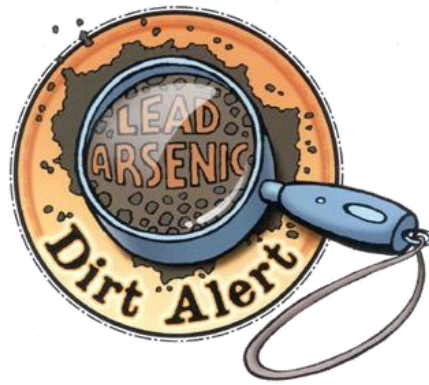
In April 2015, KCDA mailed an English survey to 5,600 households in three King County communities, Federal Way, Burien and Des Moines, impacted by the contamination. The 32% of residents who responded were primarily Caucasian, English-speaking, over the age of 65, and have lived in King County for more than 15 years. In addition, the majority of respondents were homeowners and have gardens or flowerbeds. This report finds that:

- Only 52% of people have heard something about lead and arsenic in soil within the last year.
- This information raised concern but left 56% of people uncertain about what to do next.
- Of the recommended actions to reduce contact with contaminated dirt, 70% reported always washing their hands before eating and 23% reported that they always take off shoes. If the respondent took off his or her shoes at the door, family members tended to also be more likely to take their shoes off.
- Of those who have children under the age of 10 living at home, 30% reported that their kids always wash their hands after playing outside and 53% reported that their kids always washed their hands before eating.

Next Steps

As a whole, the survey indicates that there is a moderate amount of awareness of soil pollution caused by the Asarco Smelter. We will focus future outreach on broad-based television ads and printed forms of communication, such as direct mailings, to try to increase the number of folks who know about Dirt Alert. Because more respondents from Burien tended to respond that they were uncertain on what to do to protect themselves and their families, KCDA will explore more effective communication methods in that area. KCDA will continue to conduct outreach via media publications, community events, and presentations to programs serving young children.

2015 Dirt Alert King County Awareness Survey Report



Public Health—Seattle & King County
Washington State Department of Ecology

August 26, 2015

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2015 King County Dirt Alert Awareness Survey Report

Public Health - Seattle & King County and Washington State Department of Ecology

Abstract

In April of 2015, Public Health–Seattle & King County (PHSKC) surveyed residents of three areas with arsenic and lead soil contamination from the former Asarco smelter: Burien, Federal Way, and Normandy Park.

The goal of the survey was to measure awareness of soil contamination and PHSKC’s King County Dirt Alert (Dirt Alert) outreach program. It also measured rates of behaviors that can reduce soil exposure, such as hand washing and taking off shoes.

Methods: PHSKC sent a mail survey in English to 5,600 households. The response rate for the survey was 32%. PHSKC analyzed survey results.

Results: Approximately 70% of the sample is aware of Asarco soil contamination, and 18% is aware of the Dirt Alert program. There was a slight decrease in the number of people who are aware of the Asarco contamination when compared to the 2013 King County result, but there was an increase in the number of people who are aware of the Dirt Alert program.

More people wash hands on a regular basis than take off shoes or wash fruits and vegetables grown at home. These behaviors varied by city, demographic, and awareness.

Discussion: A significant number of the survey respondents are white, English-speaking, over the age of 65, and homeowners. Based on survey results, future outreach methods should focus on broad-based television ads and printed forms of communication, including newspaper, direct mail, and email. While these methods have helped some respondents plan and feel empowered to protect themselves and their families, a greater number of respondents were concerned by the information but left uncertain about what to do next. Because respondents living in Burien tended to indicate they were concerned but uncertain on what to do, future outreach should focus on effective communication methods in that area.

Future outreach should also focus on diverse and limited English speaking communities, younger adults, and families with young children. Compared to the baseline survey results in 2013, future studies should continue to use focus groups, interviews, or targeted surveys to get more information about how to better serve these groups.

1.0 Introduction

In April 2015, PHSKC mailed 5,600 English surveys to three King County communities. The goal was to measure awareness of arsenic and lead soil contamination and the King County Dirt Alert outreach program.

Dirt Alert is part of the Washington Department of Ecology (Ecology) Tacoma Smelter Plume project, which funded and collaborated on the survey.

1.1 Tacoma Smelter Plume

For almost 100 years, a company called Asarco operated a copper smelter in Tacoma. Air pollution from the smelter settled on the surface soil over a large region - more than 1,000 square miles of the Puget Sound basin. This area is called the Tacoma Smelter Plume. Arsenic, lead, and other heavy metals are still in the soil as a result of this pollution. Studies have found soil contamination in parts of King, Pierce, Kitsap, and Thurston counties.

1.2 Dirt Alert Program

For over a decade, PHSKC and Ecology have worked together to address arsenic and lead soil contamination in areas of King County. PHSKC runs the Dirt Alert outreach and education program that provides both broad-based outreach to impacted areas and targeted outreach to children, their parents and caretakers, and certain populations and communities. The two main goals are:

1. To raise awareness about soil contamination.
2. To promote behaviors—"healthy actions"—to reduce contact with soils.

From May, 2010 to September, 2012, PHSKC's outreach program was on hold. In September of 2012, PHSKC and Ecology signed an interagency agreement to restart the Dirt Alert program.

1.3 Purpose of the Baseline Survey

Even before 2010, residents in south King County received limited broad-based outreach. PHSKC's program targeted specific populations and broader outreach consisted mainly of cable television advertising. In the spring of 2013, PHSKC began rebuilding the Dirt Alert program and increasing broad-based outreach in the summer. Spring was a good time to gather baseline data about awareness and behaviors.

Ecology plans to fund the PHSKC Dirt Alert program at least through 2021. Follow-up surveys over the next six years will help PHSKC evaluate and further develop its broad-based outreach methods.

1.4 Past Dirt Alert Surveys in Pierce County

Tacoma-Pierce County Health Department (TPCHD) also has a Dirt Alert program, with similar activities to PHSKC. TPCHD has completed six major mail surveys over the past ten years:

- 2003 – University Place (general population)
- 2004 – University Place (general population)

- 2005 – Lakewood, Steilacoom, and Tacoma (baseline survey, households with children)
- 2007 – University Place, Lakewood, Steilacoom, and Tacoma (follow up)
- 2007 – Ruston (residences within the Superfund site)
- 2009 – University Place, Lakewood, Steilacoom, and Tacoma (follow up)
- 2014 – University Place, Lakewood, Steilacoom, and Tacoma (follow up)

The surveys measured level of awareness and behavior change in Pierce County communities. One key finding of the follow up surveys was that awareness and behavior change seems to be related to the level of contact, with direct mail and television being the most influential methods of contact.

1.5 Past Surveys in King County

2009 King County Phone Survey - In June, 2009, PHSKC’s contractor PRR conducted a baseline telephone survey of families with children under the age of 18, within certain zip codes of the Tacoma Smelter Plume. It measured the following:

- Level of concern about soil contamination.
- Level of awareness.
- Method of hearing about the Tacoma Smelter Plume.
- Changes made to reduce exposure.

The survey had a response rate of 16% and was not representative of the population being surveyed. As more people replace home phones with cell phones, phone surveys are becoming less useful.

2010 King County Mail Survey - In January, 2010, Ecology and PHSKC sent a mail survey to 2,400 Federal Way households and 1,600 Normandy Park households. The response rate was around 26%. Forty-nine percent of respondents indicated they knew “a little” or “quite a bit” about soil pollution caused by the Asarco smelter. Ecology has not completed analysis of the data.

2013 King County Mail Survey – In November, 2013, Ecology and PHSKC sent a mail survey to 9,900 households in Burien, Des Moines, Federal Way, Normandy Park, and Vashon Island. The response rate was 27%. Fifty percent of respondents indicated that they knew “a little” or “a lot” about contamination caused by the Asarco smelter.

2.0 Methods

2.1 Survey Instrument

This survey instrument closely follows TPCHD's 2009 and PHSKC's 2013 surveys. This allows for comparison across counties and between years. The survey asks about awareness of soil contamination and behaviors people take to reduce contact with soil. It also looks at sources of information and attitudes about the issue.

The survey is designed to gather the following data:

- Awareness of ASARCO smelter contamination and the Dirt Alert program.
- Where people found information on these topics.
- Healthy practices such as hand washing and taking off shoes at the door.
- Demographics such as age, race, and homeownership.

The survey instrument is in **Appendix A**.

2.2 Survey Implementation, Processing, and Analysis

Surveys went to 5,600 English-speaking residents of three communities within King County— Burien, Federal Way, and Normandy Park, Burien. Federal Way and Burien are more socio-economically diverse and have received less past outreach. Normandy Park is a more affluent community that has historically received more outreach.

PHSKC purchased mailing lists for the following areas:

- In Federal Way, within the Soil Safety Program Service Area (Figure 1).
- In Normandy Park, and Burien, from throughout the city limits.

PHSKC's contractor Cascadia Consulting Group (Cascadia) mailed out all of the surveys on scannable forms, with a postage-paid return envelope. Respondents were given the option of mailing in the completed survey or responding to the survey online. PHSKC sent out a reminder post card about one week after surveys were mailed.

Cascadia scanned the surveys and hand-entered written responses. They provided PHSKC and Ecology with a database of results. The online responses were downloaded and reviewed by PHSKC. Online respondents were more likely to be male, between the age or 46-65, and white; however, it did not appear that these differences made any significant difference on the results. Given this, the online results were merged with the scanned results.

PHSKC analyzed the data using SPSS 18 for frequencies and chi-square tests and Stata 11 for logistic regression. Open-ended responses were coded by PHSKC. Graphs were created in SPSS.

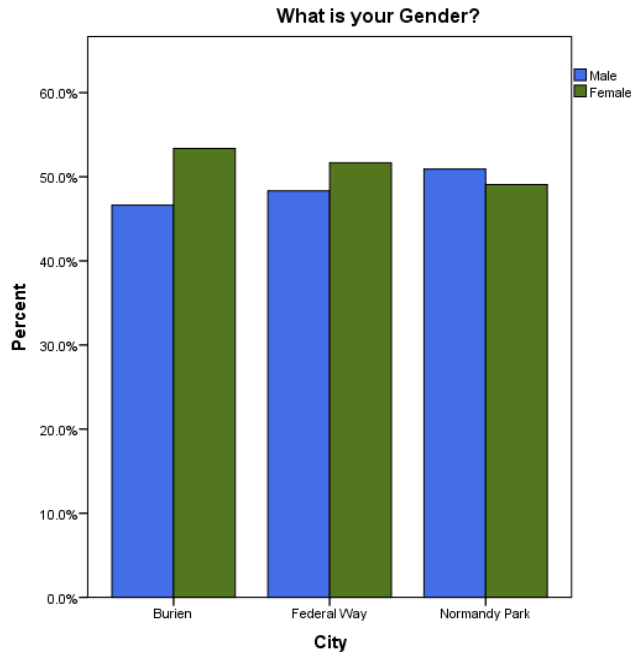
3.0 Demographics and Home Environment

The response rate for the survey was 32%, with 1,817 responses.

Area	Surveys Mail	Mailed Responses	Online responses	Total Responses	Response rate
Burien	2,000	593	62	655	33%
Federal Way	2,000	512	81	593	30%
Normandy Park	1,600	500	69	569	36%
Total	5,600	1,605	212	1,817	32%

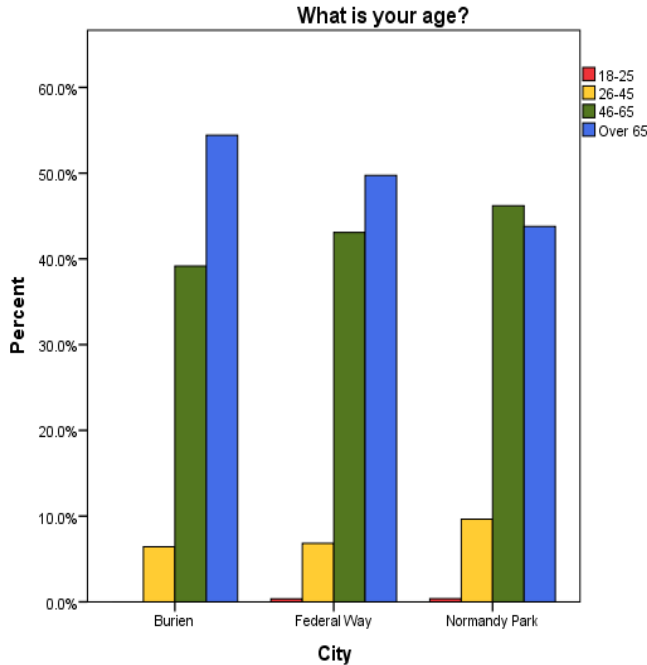
3.1 Gender: 49% were female

Respondents were 49% female and 46% male. Gender of respondent did not vary significantly by region, $\chi^2(2, N = 1737) = 2.15, p > .01$.



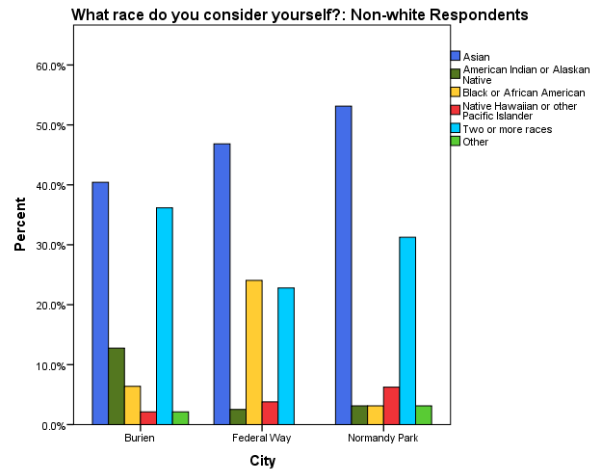
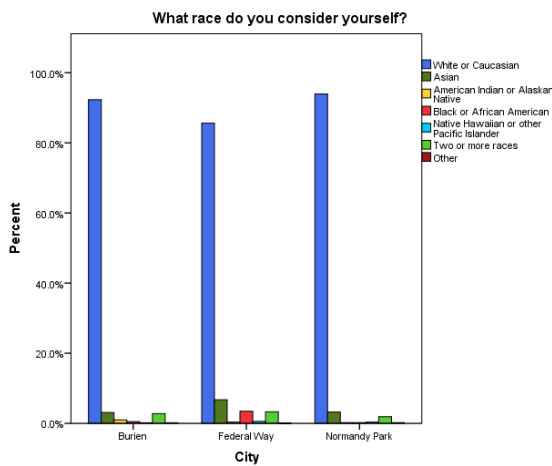
3.2 Age: 47% were 65 years old or older

The largest age category was 65 years old or older (47%), followed by 46-65 years old (41%). There appears to be more respondents over the age of 65 living in Burien compared to Normandy Park, $\chi^2(6, N = 1733) = 16.8, p < .01$.



3.3 Race: 84% were white

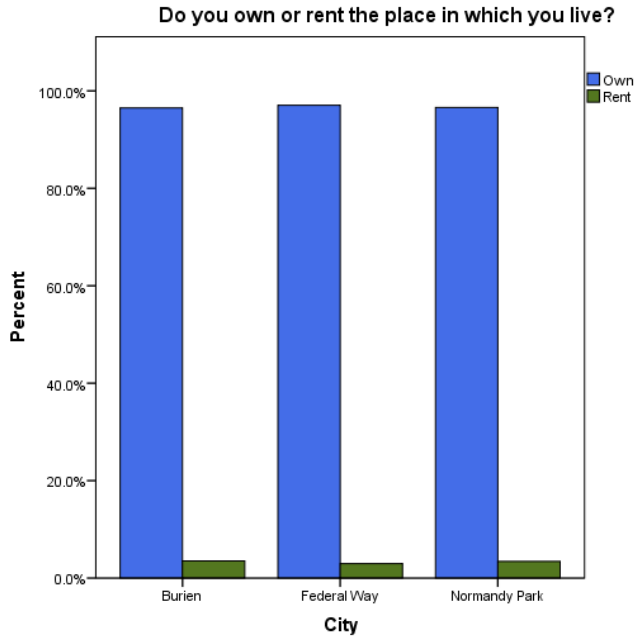
Race was asked separately from Hispanic, Latino, or Spanish-speaking origin. Most respondents were white (84%). The next largest group was Asian (4%). Only 2% were of a Hispanic, Latino, or Spanish-speaking background. Federal Way appeared to have the largest number of non-White respondents, $\chi^2 (2, N = 1688) = 25.1, p < .01$.



3.4 Housing: 94% were homeowners

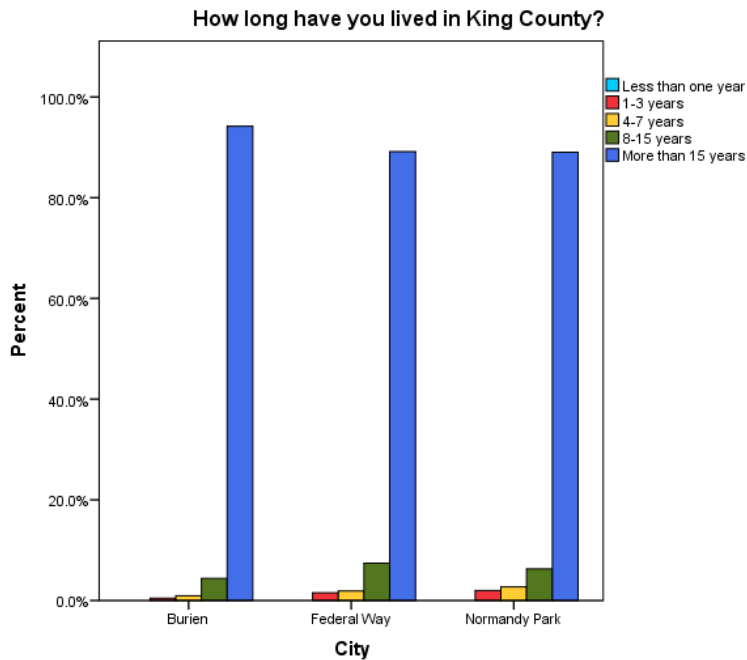
Homeowners made up 94% of the sample. There were no significant differences in homeownership by city, $\chi^2 (2, N = 1758) = .33, p > .01$. Most respondents reported living in a house (93%), with 2% living in an apartment and the rest in condos, duplexes, or

“other.” There were no differences in type of residence by city, $\chi^2 (6, N = 1766) = 8.22, p > .01$.



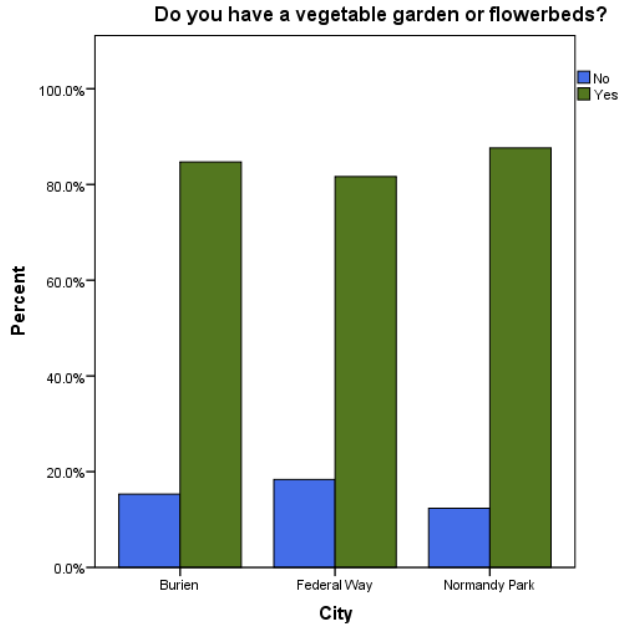
3.5 Years Lived in King County: 89% lived here for 15+ years

Most of the respondents have lived in King County more than 15 years (89%). Six percent of respondents lived in King County 8-15 years, and two percent of respondents have lived in King County for 4-7 years. Those living in Burien appeared to live in King County longer than those living in Normandy Park, $\chi^2 (6, N = 1773) = 16.7, p < .01$.

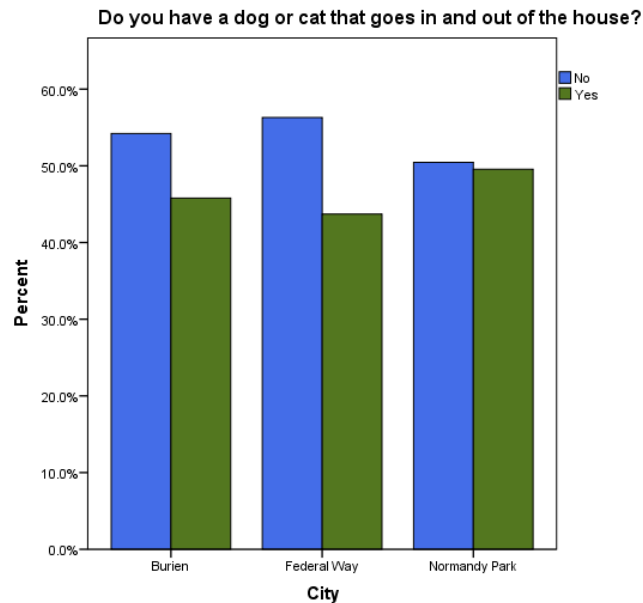


3.6 Home Environment: 83% have gardens and 46% have pets

The majority of respondents (83%) have gardens or flowerbeds. Those living in Normandy Park tended to be more likely to have a garden or flower bed compared to those living in Federal Way, $\chi^2 (2, N = 1786) = 7.9, p < .05$.



Around half (46%) have dogs or cats that go in and out of the home. There were no differences by city, $\chi^2 (2, N = 1804) = 4.1, p > .05$, but females did tend to be more likely to have a pet that went in and out of the house when compared to males, $\chi^2 (2, N = 1727) = 13.5, p < .01$.



4.0 Results

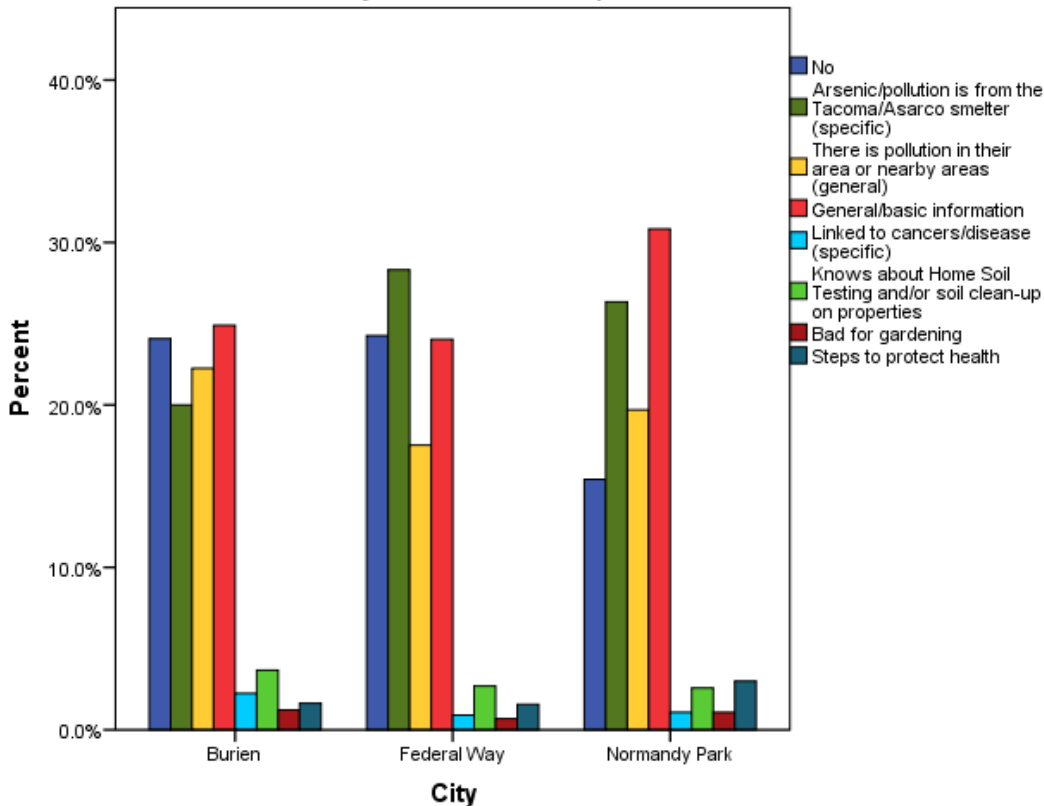
4.1 Level of Awareness

Respondents were asked to freely write what they have heard about arsenic and lead in the soil. 21% were able to provide general or basic information, 19% were able to provide specific information about the Tacoma/Asarco Smelter, and 15% were able to provide information about pollution in general. Example quotations are provided in the table below.

Response Theme	Percent
Didn't answer the question	23% (416 respondents)
General/basic information	21% (373 respondents)
<ul style="list-style-type: none"> “I am aware that there has been a problem in the past but haven't heard anything recently” 	
Pollution is from the Tacoma/Asarco smelter (specific)	19% (384 respondents)
<ul style="list-style-type: none"> “The ASARCO smelter plant formerly in Tacoma gave off smoke that contained lead and with winds [unreadable] blown in our direction could have contaminated our soil. The lead could impact our health” 	
No	16% (298 respondents)
There is pollution in their area or nearby areas (general)	15% (279 respondents)
<ul style="list-style-type: none"> “A couple of years ago Des Moines and Normandy Park talked about arsenic or lead in the soil. Guess it was minimal” 	
Knows about Home Soil Testing/oil clean-up on properties	2% (42 respondents)
<ul style="list-style-type: none"> “I have heard that the soil around our area may be contaminated due to the Asarco plant and that we can get our soil tested for free” 	
Steps to protect health	2% (29 respondents)
<ul style="list-style-type: none"> “I heard that there was arsenic and that bare feet of humans and pets should be washed before coming in the house” 	
Linked to cancers/disease (specific)	1% (20 respondents)
<ul style="list-style-type: none"> “It's poisonous. Extended exposure can lead to long term adverse side effects such as cancer, abnormal birth defects, etc.” 	
Bad for gardening	1% (14 respondents)
<ul style="list-style-type: none"> “Toxic soil-things do not grow in the ground much--use containers with purchased soil” 	

The types of information provided by respondents varied by city, $\chi^2 (16, N = 1817) = 45.9, p < .01$.

Have you heard anything about arsenic or lead in the soil? If so, please tell us what you heard in the space below.



4.1.1 Awareness of arsenic and lead in soil within the last year is 52%.

52% of respondents indicated that they have heard something about lead and arsenic in soil within the last year. As a whole, respondents remember seeing information from broad-based communication sources.

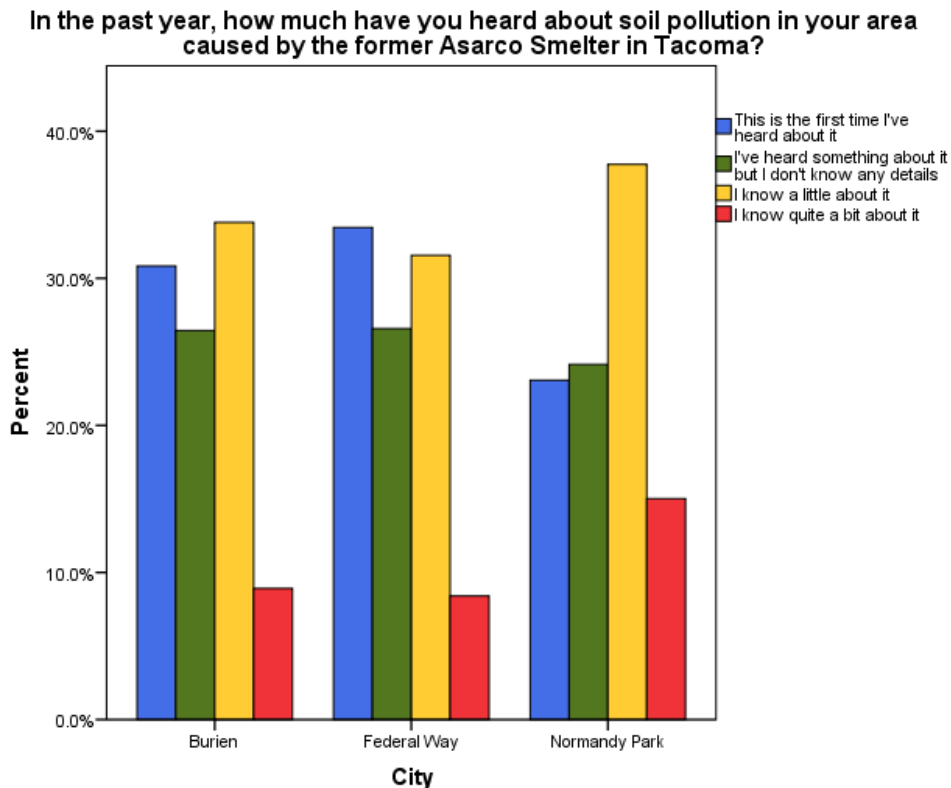
Television was the most often reported source of information (31%) for those who saw something about lead and arsenic in the last year. There were several significant differences between characteristics of the respondents and whether they saw information about lead and arsenic in the soil from a particular source. These differences are noted in the table below.

Information Source	Percent
I haven't seen any information	48% (867 respondents)
<ul style="list-style-type: none"> Males (OR = .79, 95% CI: .64-.96) KC: 7 years or less (OR = .46, 95% CI: .25-.83) Garden: No (OR = .53, 95%CI: .40-.71) 	
TV ad or program	31% (557 respondents)
<ul style="list-style-type: none"> 44 years old and younger (OR = .50, 95%CI: .26-.96) 	
Newspaper ad or article	23% (409 respondents)
<ul style="list-style-type: none"> Males (OR = .63, 95%CI: .47-.83) 45 years old or older (OR = 4.33, 95%CI: 1.97 – 9.50) 	

Information mailed to my home	11% (200 respondents)
• Normandy Park (OR= 1.30, 95%CI: 1.30 – 2.86)	
Radio	6% (113 respondents)
• Males (OR = .61, 95%CI: .39-.95)	
Internet ad or website	6% (112 respondents)
• Males (OR = .60, 95%CI: .38-.93)	
Fairs or community events	4% (70 respondents)
Information from my child's school or daycare	2% (29 respondents)
Facebook	1% (13 respondents)
Other	8% (151 respondents)

4.1.2 Awareness of Asarco contamination is 70%.

Respondents were relatively evenly split on how much information they have heard about soil pollution from the Asarco Smelter Plume in the past year. 29% heard about it for the first time in the survey, 25% of heard something about it but didn't know any details, 34% knew a little a bit about it, and 11% knew quite a bit about it. Those living in Normandy Park tended to indicate that they know quite a bit about soil pollution from the Asarco Smelter in Tacoma compared to the other the other cities, $\chi^2 (6, N = 1781) = 30.0, p < .01$. Most people had at least heard something about the issue.



On average, males, those who were 45 years old or older, those who were white, and those who had a garden were more likely to indicate they heard at least some information about soil pollution caused by the Asarco Smelter.

The table below highlights the percentages and odds ratios for each significant characteristic.

In the past year, how much have you heard about soil pollution in your area caused by the former Asarco Smelter in Tacoma?

Variable	First Time	Some, but no details	A little	Quite a bit	Odds Ratio
Male	27% (227)	26% (218)	35% (287)	12% (101)	OR = .83, 95%CI .69-.99
Female	31% (266)	26% (223)	35% (305)	9% (78)	
The odds of knowing something about soil pollution are 18% higher for males than females.					
44 years old -	39% (52)	24% (32)	33% (43)	4% (5)	OR = 1.76, 95%CI 1.21-2.57
45 year old+	38% (438)	26% (411)	35% (547)	11% (173)	
The odds of knowing something about soil pollution are 76% higher for those who were 45 years old than 44 years old and younger.					
White	27% (412)	26% (389)	36% (542)	11% (165)	OR = .56, 95%CI = .40-.78
Non-White	48% (73)	24% (37)	20% (31)	7% (11)	
The odds of knowing something about soil pollution are 44% higher for Whites than non-Whites.					
Garden: No	39% (103)	29% (78)	25%(65)	7% (18)	OR = 1.67, 95%CI: 1.29-2.17
Garden: Yes	27% (408)	25% (376)	36% (538)	11% (167)	
The odds of knowing something about soil pollution are 67% higher for those who have a garden than those who do not have a garden.					

Note. Percentages were calculated by row count/cell count. Numbers in parentheses are the counts.

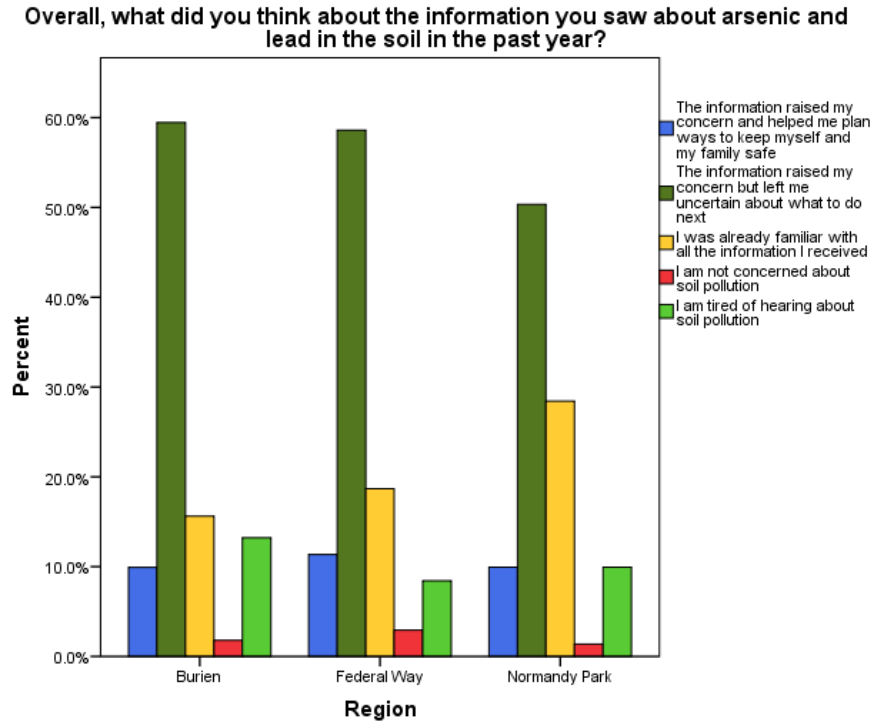
Individuals who heard information about soil pollution from television/video (OR = 5.70, 95%CI: 3.70-8.79), direct mail (OR = 3.01, 95%CI: 2.02-4.49), fairs (OR= 2.60, 95%CI: 1.38-4.90), Internet (OR = 1.74, 95%CI: 1.03-2.94), and newspaper (OR = .50, 95%CI: .34-.72) were more likely to indicate that they knew something about soil pollution.

4.1.2 Soil pollution information raised concern but left 56% uncertain about next steps.

When asked what they thought about soil pollution information, 45% of those responding to the question answered that they had not seen any. Of the respondents who had heard about the issue, the information tended to raise concern, but leave them

concerned about what to do next (56%), while 10% felt that the information helped them plan a way to keep their family safe. Twenty-one percent were already familiar with the information they received and 10% were tired of hearing about soil pollution.

Those living in Burien tended indicate that the information raised their concern but left them uncertain about what to do next, while those living in Normandy Park tended to think that they were already familiar with the information they received, $\chi^2(8, N = 898) = 21.5, p < .01$.



Whether the information helped people plan or left them indeterminate varied by the method of contact, individuals who heard the information at a fair or through direct mail were more likely to be empowered.

Contact Method	N	Helped me plan	Left me uncertain	Proportion
Fairs	65	18	17	1.06
Direct mail	184	33	76	.43
Internet	106	18	53	.33
Radio	102	14	51	.27
TV	515	53	292	.18
School or daycare	25	3	14	.21
Newspaper	378	33	202	.16

Note. Proportion was calculated by (Helped my plan/Left me uncertain).

Additionally, those who were non-White were more likely to not be empowered by the information they heard (OR = .20, 95%CI: .10-.38).

4.1.4 Awareness of Dirt Alert is 18%

Of the total survey respondents, 18% had heard of the Dirt Alert program. Females and those who were 44 years old or younger tended to indicate that they had heard about the “Dirt Alert” program.

The table below highlights the percentages and odds ratios for each significant characteristic.

Have you heard about a program called “Dirt Alert”?			
Variable	Yes	No	Odds Ratio
Male	12% (69)	88% (488)	OR = 2.08, 95%CI: 1.49-2.91
Female	24% (149)	76% (481)	
The odds of hearing about “Dirt Alert” were 108% higher for females than males.			
45 year old+	17% (187)	83% (918)	OR = .36, 95%CI: .20-.66
44 years old -	35% (28)	65% (52)	
The odds of hearing about “Dirt Alert” were 64% higher for those 45 years old or older than those who were 44 years old or younger.			

Note. Percentages were calculated by row count/cell count. Numbers in parentheses are the counts.

Respondents who knew about the “Dirt Alert” program were likely to have heard information about soil pollution through television (OR = 6.56, 95%CI: 4.59-9.39), direct mail (OR = 3.14, 95%CI: 2.13-4.67), fairs (OR = 2.67, 95%CI: 1.43-5.00), and the Internet (OR = 1.80, 95%CI: 1.06-3.04). Respondents who knew about the “Dirt Alert” program were less likely to have heard information about soil pollution from the newspaper (OR = .51, 95%CI: .35-.78).

4.1.5 Contact Preferences: 68% preferred mailings.

As a whole, respondents preferred more board-based communication compared to one-on-one contact. For each method of contact, there were several types of respondents who indicated a stronger preference than others.

Communication Preference	Percent
Mailings or email	68% (1231 respondents)
<ul style="list-style-type: none"> Children under 10 (OR = 1.77, 95%CI: 1.18-2.65) 	
Radio or newspaper	43% (776 respondents)
Videos (TV or Online)	32% (583 respondents)
<ul style="list-style-type: none"> Non-white (1.80 95%CI: 1.27-2.55) 	
Websites (Including Facebook)	21% (373 respondents)
<ul style="list-style-type: none"> 44 years old and younger (OR = .38 95%CI: .25-.59) 	
Fairs or community events	11% (206 respondents)
<ul style="list-style-type: none"> Female (OR = 1.64, 95%CI: 1.18-2.28) 	

Family, friends, or neighbors	9% (157 respondents)
<ul style="list-style-type: none"> 44 years old and younger (OR = .50, 95%CI: .28-.89) 	
My child's school or care provider	5% (88 respondents)
<ul style="list-style-type: none"> 44 years old and younger (OR = .33, 95%CI: .18-.59) White (OR = 2.58, 95%CI: 1.35-4.95) Own Home (OR = 3.93, 95%CI: 1.58-9.79) Children under 10 (OR = 8.59, 95%CI: 4.93-14.95) 	
Community or religious leaders	4% (74 respondents)
<ul style="list-style-type: none"> Non-white (OR = 3.12, 95%CI: 1.70-5.75) 	
Other	5% (91 respondents)

4.2 Adult Actions to Reduce Soil Contact

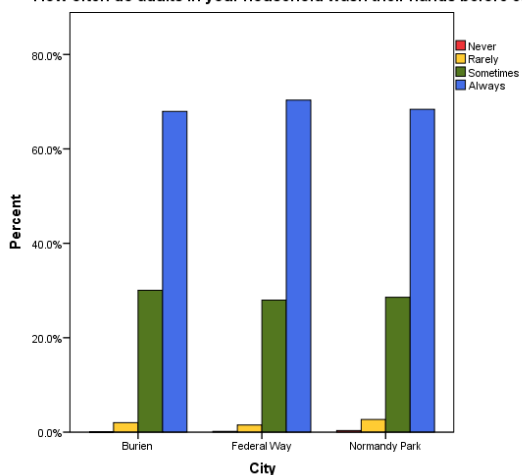
4.2.1 Personal Health Actions: 70% always wash their hands.

Seventy percent of respondents reported always washing their hands before eating, 47% reported always washing fruits and vegetables grown at home (47%), and 23% reported that they always take off shoes.

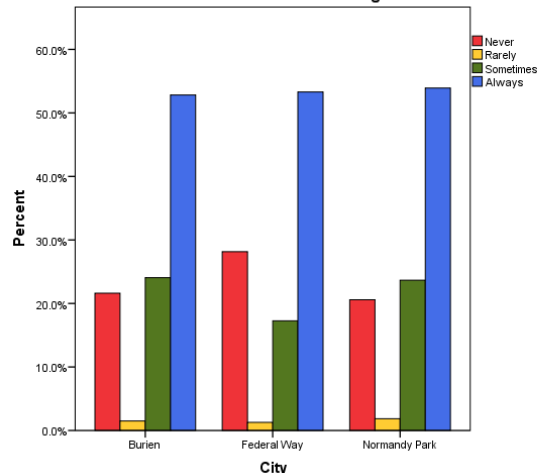
There were no differences in hand washing behavior by city. Those in Federal Way tended to indicate that they never wash their fruits and vegetables that were grown at home, $\chi^2 (6, N = 1487) = 13.9, p < .05$.

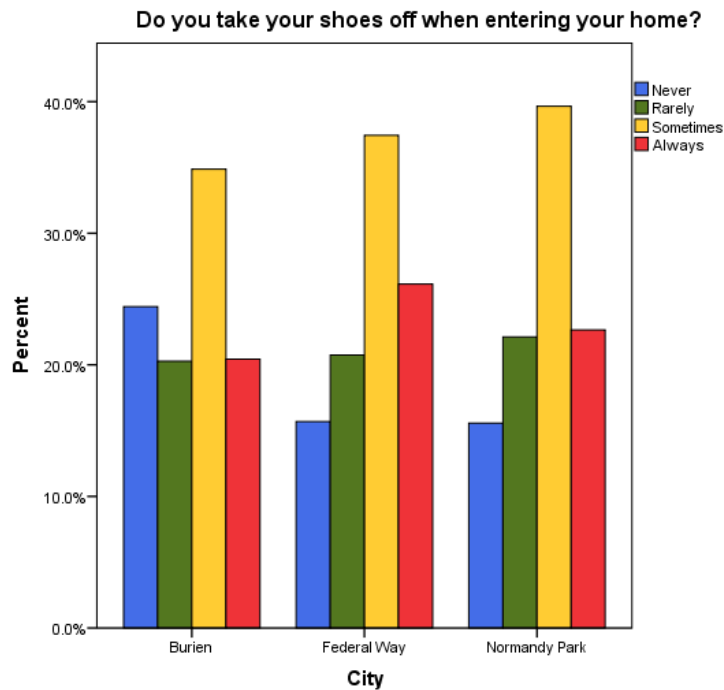
If the respondent took off his or her shoes before entering the house, family members tended to also be more likely to take their shoes off (Cramer's $V = .71, p < .05$). Those living in Burien tended to be more likely to never take their shoes off ($\chi^2 (6, N = 1809) = 23.9, p < .01$) when compared to the other cities.

How often do adults in your household wash their hands before eating?



If you grow fruits and vegetables in your garden, do people in your household wash them before eating them?





Respondents with certain characteristics tended to be more likely to engage in behaviors that reduced soil contact.

Non-whites, those who do not have children under the age of 10 living at home, and those who do not have a garden were likely to indicate that the adults in their household always wash their hands before eating. The table below highlights percentages and odds ratios for each significant characteristic.

How often do the adults in your household wash their hands before eating?

Variable	Never	Rarely	Sometimes	Always	Odds Ratio
White	0% (1)	2% (35)	30% (462)	67% (1022)	(OR = 1.95, 95%CI: 1.27-2.99)
Not-White	0% (1)	1% (2)	18% (28)	80% (127)	
The odds of washing one's hands before eating were 95% higher for non-Whites than Whites.					
Children: No	0% (2)	2% (31)	27% (424)	70% (1092)	(OR = .54, 95%CI: .39-.77)
Children: Yes	0% (0)	2% (5)	38% (85)	60% (134)	
The odds of washing one's hands before eating were 45% higher for those without children were than those with children.					
Garden: No	0% (0)	2% (6)	22% (60)	76% (205)	(OR = .71, 95%CI: .51-.99)
Garden: Yes	0% (3)	2% (31)	30% (448)	68% (1020)	

The odds of washing one's hands before eating were 29% higher for those who do not have a garden than those with a garden

Note. Percentages were calculated by row count/cell count. Numbers in parentheses are the counts.

Those who are younger, non-White, do not have a pet that goes in and outside of the house tended to be more likely to take their shoes off when entering the home. The table below highlights percentages and odds ratios for each significant characteristic.

Do you take your shoes off when entering your home?

Variable	Never	Rarely	Sometimes	Always	Odds Ratio
44 year old-	8% (11)	15 (11%)	46% (62)	34% (46)	OR = .48, 95%CI: .33-.70
45 years old +	20% (314)	22% (345)	37% (587)	22% (348)	

The odds of taking one's shoes off are 52% higher for those who are 44 years old and younger than those who are 45 years old or older

White	20% (300)	22% (336)	39% (590)	20% (300)	OR = 3.34, 95%CI: 2.38-4.69
Non-White	12% (18)	11% (17)	27% (43)	50% (79)	

The odds of taking one's shoes off are 234% higher for those who are non-Whites than those who are White.

Pet: No	18% (172)	20% (196)	35% (334)	27% (262)	OR = .72 95%CI: .60-.87
Pet: Yes	20% (168)	22% (181)	40% (333)	18% (153)	

The odds of taking one's shoes off are 28% higher for those who do not have a pet that goes in and out of the house than those who do have a pet that goes in and out of the house.

Note. Percentages were calculated by row count/cell count. Numbers in parentheses are the counts.

Those who are non-White tended to be more likely to always wash fruits and vegetables grown at home.

If you grow fruits and vegetables in your garden, do people in your household wash them before eating them?

Variable	Never	Rarely	Sometimes	Always	Odds Ratio
White	24% (306)	2% (21)	23% (290)	52% (659)	OR = 2.01 95%CI: 1.31-3.13
Not-White	28% (21)	0% (0)	11% (12)	69% (75)	

The odds of washing fruits and vegetable grown at home are 101% higher for those who are non-White than those who are White.

Note. Percentages were calculated by row count/cell count. Numbers in parentheses are the counts.

4.2.2 Home Cleaning Actions: 50% dust with a damp cloth.

About half of the respondents reported dusting with a damp cloth (50%). Those who were male, non-White, and had a pet were tended to be more likely to use a damp cloth.

Do you (or someone else) use a damp cloth when dusting your home?

Variable	No	Yes	Odds Ratio
Male	46% (378)	54% (451)	OR = .76, 95%CI: .62-.93
Female	53% (464)	47% (416)	

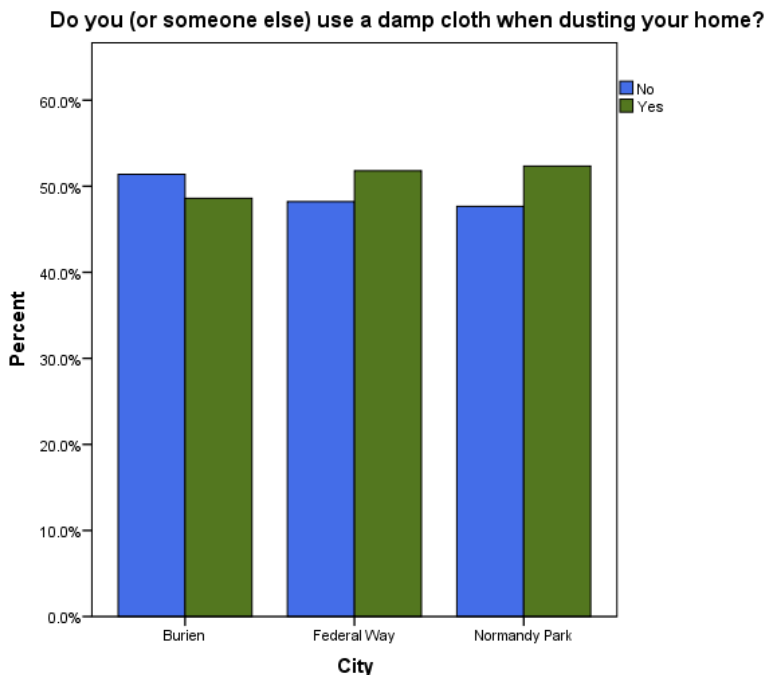
The odds of using a damp cloth when dusting were 24% higher for males than females.

White	51% (767)	49% (743)	OR = 1.71, 95%CI: 1.20-2.46
Not White	38% (59)	62% (96)	

The odds of using a damp cloth when dusting were 71% higher for those who were non-White than those who were White.

Pet: No	52% (497)	48% (455)	OR = 1.43 95%CI: 1.17-1.76
Pet: Yes	46% (376)	54% (447)	

The odds of using a damp cloth to dust were 43% higher for those who had a pet that went outside than those who do not have a pet that goes outside.



47% of respondents vacuum their home 1-3 times a month and 42% of respondents vacuum their home 1-6 times a week. Males, those with a garden, those with a pet that goes in and out of the house, and those who have children under the age of 10 living in the homes tended to be more likely to vacuum at least once a month.

How often do you (or something else) vacuum your home?

Variable	Less than once a month	1-3 times a month	1-6 times a week	1 or more times a day	Odds Ratio
Male	6% (51)	47% (393)	45% (381)	2% (18)	OR = .76, 95%CI: .66-.97
Female	8% (67)	48% (428)	40% (352)	5% (43)	

The odds of vacuuming one's home more than once a month were 24% higher for males than females.

Garden: No	11% (30)	49% (133)	39% (105)	2% (5)	OR = 1.52, 95%CI: 1.16-2.00
Garden: Yes	6% (95)	47% (712)	43% (645)	3% (58)	

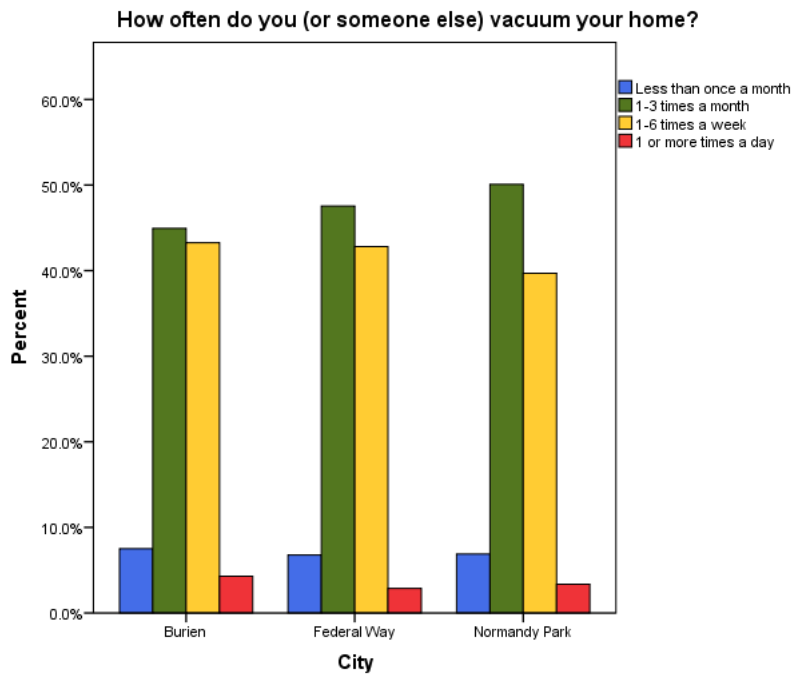
The odds of vacuuming one's home more than once a month were 52% higher for those who have a garden than those who do not have a garden.

Pet: No	9% (85)	50% (484)	38% (367)	3% (29)	OR = 1.41 95%CI: 1.16-1.71
Pet: Yes	5% (41)	45% (372)	46% (387)	4% (35)	

The odds of vacuuming one's home more than once a month were 41% higher for those who have a pet that goes in and out of the house than those who do not have a pet that goes in and out of the house.

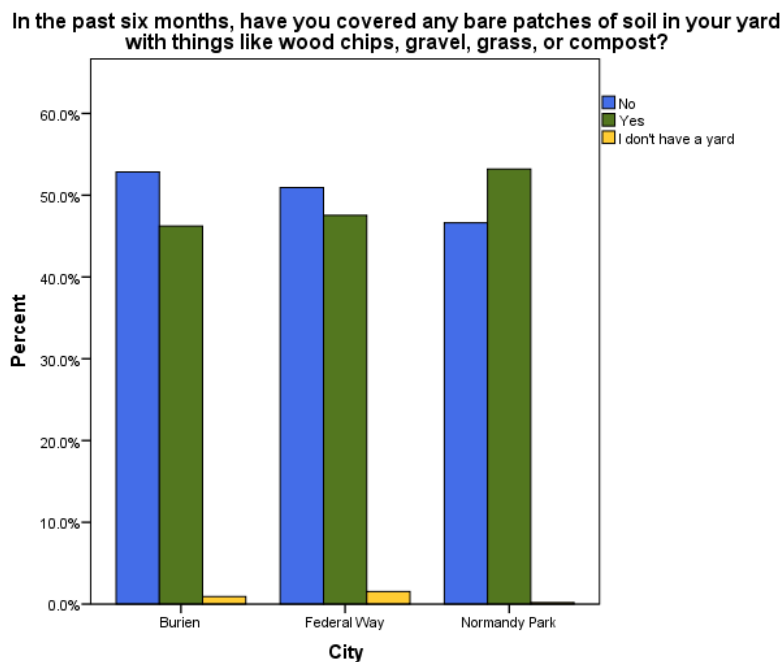
Children: No	7% (110)	49% (758)	41% (637)	3% (52)	OR = 1.44 95%CI: 1.04-2.00
Children: Yes	7% (16)	39% (87)	49% (108)	5% (11)	

The odds of vacuuming one's home more than once a month were 44% higher for those who have children than those who do not have children.



4.2.3 Covering Bare Soil with Materials: 48% did in the last six months.

In the past six months, 48% of respondents have covered over bare patches of soil in their yard with some material.



Those who had a garden, had a pet that went in and out of the house, and had children under 10 living at home were more likely to cover bare patches in the yard.

In the past six months, have you covered any bare patches of soil in your yard with things like wood chips, gravel, grass, or compost?

Variable	No	Yes	Odds Ratio
Garden: No	70% (75)	25% (27)	OR = 3.46, 95%CI: 2.51-4.76
Garden: Yes	43% (335)	56% (436)	

The odds of coving bare patches were 246% higher for those who have a garden than those who do not have a garden.

Pet: No	47% (221)	50% (230)	OR = 1.23 95%CI: 1.03-1.56
Pet: Yes	44% (192)	55% (237)	

The odds of covering bare patches were 3% higher for those who have a pet that goes in and out of the house compared to those who do not have a pet that goes in and out of the house.

Children: No	49% (376)	50% (385)	OR = 1.53 95%CI: 1.09-2.17
Children: Yes	31% (35)	67% (75)	

The odds of covering bare patched were 53% higher for those who have children under 10 compared to those who do not have children under 10.

4.2.4 Adult actions were related to level of soil pollution awareness.

Of the six actions (washing food grown at home, covering bare soil patches, taking off shoes, washing hands before eating, vacuuming, and damp dusting), two actions varied significantly by awareness of soil pollution.

Variable	First Time	Some, but no details	A little	Quite a bit	Odds Ratio
Covering bares patches	No = 56% (289)	No = 50% (228)	No = 46% (278)	No = 47% (87)	OR = 1.17, 95%CI: 1.07-1.30
	Yes = 43% (220)	Yes = 50% (222)	Yes = 54% (324)	Yes = 54% (102)	

The odds of covering bare patches in the yard were 17% higher for those who heard something about soil pollution.

Wash Fruits	Never = 24% (98)	Never = 26% (96)	Never = 23 (121)	Never = 16% (26)	OR = 1.12, 95%CI: 1.01-1.23
	Rarely = 2% (8)	Rarely = 2% (8)	Rarely = 1% (4)	Rarely = 2% (3)	
	Sometimes =23% (92)	Sometimes = 21% (77)	Sometimes = 22% (117)	Sometimes = 21% (35)	
	Always = 51% (204)	Always = 51% (191)	Always = 54% (285)	Always = 61% (101)	

The odds of washing fruits and vegetable grown at home are 12% higher for those who heard something about soil pollution.

Several actions were also related to what the individual thought about the information they heard:

- The odds of washing hands before eating were 206% higher for those who indicated that the information they heard helped them plan compared to those who indicated that the information left them uncertain. (OR = 3.06, 95%CI: .1.69-5.55)
- The odds of taking off shoes before entering the home were 95% higher for those who indicated that the information they heard helped them plan compared to those who indicated that the information left them uncertain. (OR = 1.95, 95%CI: 1.31-2.88)
- The odds for taking off shoes was 40% higher for those were left uncertain compared to those who are tired of hearing information about soil pollution (OR = .60, 95%CI: .41-.87).
- The odds of damp dusting were 77% higher for those who indicated that the information helped them plan compared to those who were left uncertain (OR 1.77, 95%CI: 1.13-2.80)
- The odds of covering bare patches was 31% higher for those who were left uncertain compared to those who heard the information about soil pollution for the first time on the survey. (OR = .69, 95%CI: .56-.87)

4.2.5 Adult actions were related to the level of Dirt Alert awareness.

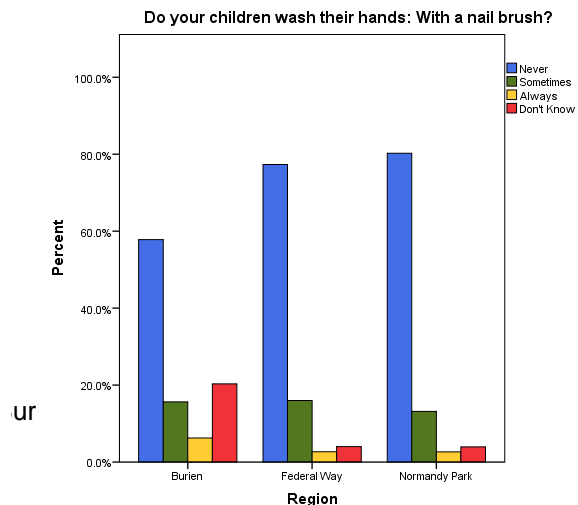
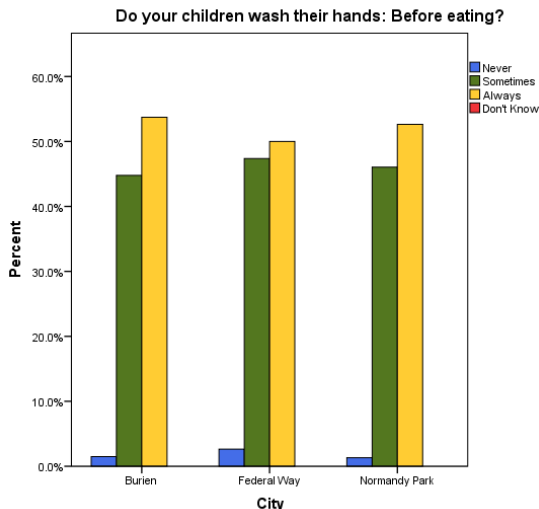
Of the six actions described in this section, only covering bare patches varied significantly by awareness of Dirt Alert.

Variable	Aware of Dirt Alert	Odds Ratio
Covering bare patches	Yes:45% (98) No: 56% (122) I don't have a yard: 0% (0)	OR = .70, 95%CI: .52-.94

4.3 Child Actions to Reduce Soil Contact

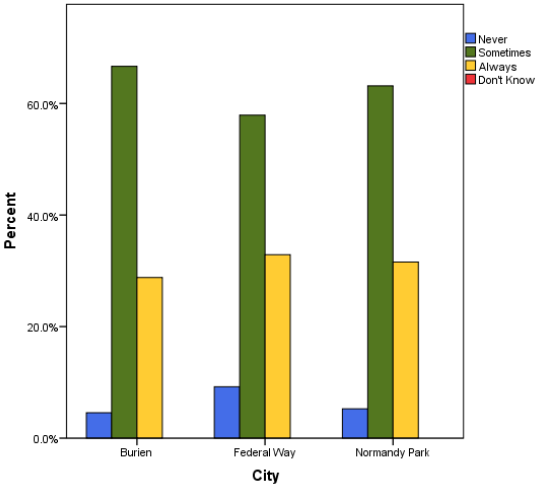
Thirteen percent of respondents had children under the age of 10 living in the home.

Of those who have children living at home, 30% have children who always wash their hands after playing outside and 62% have children who sometimes wash their hands after playing outside. 53% have children



who always wash their hands before eating, and 45% have children who sometimes wash their hands before eating. 70% have children who never use a nail brush. Those living in Burien tended to never use a nail brush compared to the other cities ($\chi^2(6, N = 215) = 18.2, p < .01$).

Do your children wash their hands: After playing outside?



5.0 Discussion

5.1 Sample Representativeness

Respondents to the survey were evenly split between male and female which is reflective of the demographics in the three areas that were surveyed. People who are **Caucasian**, over the age of 65 and homeowners were significantly overrepresented in the sample (Appendix B). It is possible that the results of the survey are skewed toward the responses from these three groups.

5.2 Implications for Outreach Programs

As a whole, the survey indicates that there is a moderate amount of awareness of soil pollution caused by the Asarco Smelter. Most of the respondents had at least heard something about soil pollution; however, about half of those respondents were uncertain about what steps they could take to protect themselves and their families. Additionally, many of the respondents follow the recommended actions, though it is unclear if this is because of awareness of the issue or due to other factors.

Direct mail or email appeared to be a preferred and impactful way to communication with the survey population. Direct may be an effective way to balance sending out the information broadly as well as creating a feeling of empowerment. Outreach in the future will want to consider how to use this information source effectively.

Awareness by itself does not necessarily indicate that the individual will follow the advocated actions. This is evident in the fact that many of the specific actions explored in the survey were not related to knowing something about the issue. Additional work is needed to explore how outreach materials can be tailored to different audience groups. Future outreach efforts may want center on decreasing the barriers that individuals face when trying to engage in the action and highlighting motivators to doing the actions.

Based on the survey, future outreach may want to target the following demographic groups:

- Those living in Burien
- Those who are **non-Caucasian**
- Families with young children

5.3 Comparison to King County Data

This section compares survey data to the 2013 King County Baseline Survey Report.

There were fewer female respondents in the 2015 survey compared to the 2013 survey. 2015 respondents were also older, more likely to own their home, and lived in King County longer than those who responded to the 2013 survey.

Variable	2013	2015
Awareness of soil pollution	71%	70%
Awareness of Dirt Alert	15%	18%
Most common source of information	Television, newspaper, direct mail	Television, newspaper
Most empowering source of information	School/daycare, fair	Fairs, direct mail

Note. The 2013 report surveyed Burien, Des Moines, Federal Way, Normandy Park, and Vashon Island. Des Moines and Vashon Island were removed for this comparison analysis.

Respondents to the 2015 survey appear to be more uncertain about what to do next regarding the information they heard (56%) when compared to the 2013 survey (38%).

On average, there was not much change in the percentage of respondents who always follow the advocated actions. There were a few exceptions.

Variable	2013	2015
Hand Washing	73% (Normandy Park)	68% (Normandy Park)
Take off Shoes	35% (Federal Way)	26% (Federal Way)
Cover Bare Patches	37% (Federal Way)	48% (Federal Way)

5. 4 Strengths, Limitations, and Lessons Learned

There were several strengths of this survey. First, there were several groups who are appropriately represented in the survey. Most of the respondents were homeowners which is a primary target audience for outreach. There was also an adequate split between male and female respondents. Second, the response rate for the survey was higher than expected. The online option for respondents may have boosted the response rate.

One of the major limitations of the survey is that the respondents to the survey were not representative of the population as a whole, thus caution should be taken in applying the findings to the population. Another limitation is that the survey cannot be used to make any causal inferences between awareness of the “Dirt Alert” program or knowledge of soil pollution.

In the future, attention should be paid to the wording of the questions asked on the survey. The awareness questions were prefaced by the phrase “in the past year.” It is unclear if the responses to the questions took this into account or not. It is possible that someone could have heard about soil pollution in the past, but not in the last year so they would have indicated that they had not heard any information. This could potentially skew the results.

Appendix A. Survey Instrument

■ Tacoma Smelter Plume King County Awareness Survey ■

1. Have you heard anything about arsenic or lead in the soil? If so, please tell us what you heard in the space below.

2. Do you have a vegetable garden or flowerbeds? Yes No

3. If you grow fruits and vegetables in your garden, do people in your household wash them before eating them?

- Always
- Sometimes
- Rarely
- Never
- I don't grow fruits and vegetables.

4. In the past six months, have you covered any bare patches of soil in your yard with things like wood chips, gravel, grass, or compost?

- Yes No I don't have a yard

5. Do you have a dog or cat that goes in and out of the house?

- Yes No

6. Do you take your shoes off when entering your home?

- Always Sometimes Rarely Never

7. Do other members of your household take their shoes off when entering your home?

- Always Sometimes Rarely Never

8. Do your guests take their shoes off when entering your home?

- Always Sometimes Rarely Never

9. How often do you (or someone else) vacuum your home? (Select one.)

- 1 or more times a day 1-3 times a month
 1-8 times a week Less than once a month



10. Do you (or someone else) use a damp cloth when dusting your home?

Yes No

11. How often do adults in your household wash their hands before eating?

Always Sometimes Rarely Never

12. Do you have any children under 10 living in your home some or all the time?

Yes No >> please skip to question 14

13. Do your children wash their hands...

	Always	Sometimes	Never	Don't know
After playing outside?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Before eating?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
With a nail brush?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. In the past year, how much have you heard about soil pollution in your area caused by the former Asarco Smelter in Tacoma? Pick just one.

- This is the first time I've heard about it.
- I've heard something about it but don't know any details.
- I know a little about it.
- I know quite a bit about it.

15. In the past year where have you seen information about lead and arsenic in the soil and how to protect yourself? Please check all that apply.

- a. I haven't seen any information.....
- b. TV ad or program.....
- c. Internet ad or website
- d. Information mailed to your home
- e. Information from your child's school or daycare.....
- f. Newspaper ad or article.....
- g. Fairs or community events
- h. Facebook
- i. Radio.....

j. Other

16. Overall, what did you think about the information you saw about arsenic and lead in the soil in the past year? Pick one statement.

- I don't recall seeing any information. >> please skip to question 18
- The information raised my concern and helped me plan ways to keep myself and my family safe.
- The information raised my concern but left me uncertain about what to do next.
- I was already familiar with all the information I received.
- I am not concerned about soil pollution.
- I am tired of hearing about soil pollution.

17. Have you heard about a program called "Dirt Alert"?

- Yes
- No



18. How do you prefer getting information about soil pollution and what you can do? Check all that apply.

- a. Videos (TV or online).....
- b. Websites (including Facebook).....
- c. Mailings or e-mail.....
- d. My child's school or care provider.....
- e. Family, friends, or neighbors.....
- f. Community or religious leaders.....
- g. Radio or newspaper.....
- h. Fairs or community events.....

i. Other

Now we have some questions about you. This information will help us provide better service to your community. If you do not feel comfortable answering a question, skip it.

19. What is your gender?

- Male
- Female

20. What is your age?

- 18-25
- 26-45
- 46-65
- Over 65

21. Are you from a Hispanic, Latino, or Spanish-speaking background?

- Yes
- No

22. What race do you consider yourself?

American Indian or Alaska Native

Asian

Black or African American

Native Hawaiian or other Pacific Islander

White or Caucasian

Two or more races

Other

23. Do you own or rent the place in which you live? Own Rent

24. Which of the following best describes your housing?

House

Apartment

Condominium or townhouse

Duplex or triplex

Other

25. How long have you lived in King County?

Less than one year

4-7 years

More than 15 years

1-3 years

8-15 years

26. Do you have anything else you'd like to tell us?

27. I would like to receive information about:

Dirt Alert Program and free Home Soil Testing

Survey Results

Name:

Phone Number:

Email Address:

Street Address:

City:

Zip Code:

Thank you for participating in this important survey!