Going Beneath the Surface:
Petroleum Pollution, Regulation, and Health

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Online Appendix

Appendix

Additional Data

Public Water Supply Areas
A public water system (PWS) provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year. Public water systems may be publicly or privately owned. This paper utilizes GIS data from New Jersey and Pennsylvania on community water systems, which supply water to the same population year-round. Unfortunately, the Florida Department of Environmental Protection (FL DEP) does not maintain community water supply service areas for the state, so any analysis utilizing PWS areas will exclude Florida.

Community water service area boundaries for New Jersey come from the New Jersey Department of Environmental Protection (NJ DEP) (Carter et al., 2004).[21] New Jersey Public Community Water Supply Purveyor service areas boundaries were collected and digitized to enable long term water supply planning, and to aid in emergency management during drought. The Pennsylvania Department of Environmental Protection (PA DEP) also provides a digitized map of the boundaries of the current public water supplier's (PWS) service areas (PADEP, 2015). These data contain over 90 percent of active service boundary areas for Pennsylvania public community water supplies. As part of Pennsylvania's State Water Plan, this data is used to determine non-public water supply areas (i.e. self-supplied), the population served, and water supply demand. Figure A1 shows PWS areas for both Pennsylvania and New Jersey.

PWS Water Quality violations and source well data
For Pennsylvania, I obtain data on PWS water quality violations and well location data. Water quality violation data from the PA DEP includes all PWS violations of any Maximum Contaminant Level (MCL). I exclude bottled water, bulk water, retail water, and vended water systems from the analysis. Table A1 shows violation data summary statistics for the volatile organic chemicals (VOCs) regulated by the PA DEP and the MCL for each. VOC violations are the most likely type of violation to occur as a result of leaking petroleum products. Pennsylvania wells data comes from the Pennsylvania Groundwater Information System (PaGWIS), which contains water well latitude and longitude for a large number of wells in the state.[22] I link PWS wells to PWS areas based on overlapping geographies. This will be measured with some error since PWS services may draw water from a well outside of their own PWS area and I cannot identify which of these wells service which PWS area. I assume that a PWS well located within a PWS area services that area. I link leaking underground storage tanks within 600 meters to PWS wells to explore the relationship

[21] This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJ DEP and is not state-authorized.

[22] Records submitted by drillers have been added to PaGWIS starting in 1969, but data entry varied substantially over time. Due to insufficient staff, no records were entered for several years, creating a large backlog. Although some of these data have subsequently been entered into the system and electronic submission of new records is now mandatory, large gaps still exist. PA is estimated to have over 1 million domestic water wells, but there are only 440,000 records in PaGWIS.

of leaks near PWS supply wells with PWS water quality violations.

Direct Notifications

Since 2005, Florida has maintained a database with information on public notification of possible contamination for routine site cleanups. In emergency situations, the public is notified immediately and these emergency notifications would not show up in these data. According to conversations with the FL DEP, most sites do not require immediate emergency notification so the standard procedures are followed. Exceptions might include some roadside spills (from truck accidents, etc.) which are addressed immediately by response crews. These data identify the date of initial notice of contamination beyond property boundaries, which is required during the assessment phase of a cleanup. I use these data to explore the impact of public notification on avoidance behaviors.

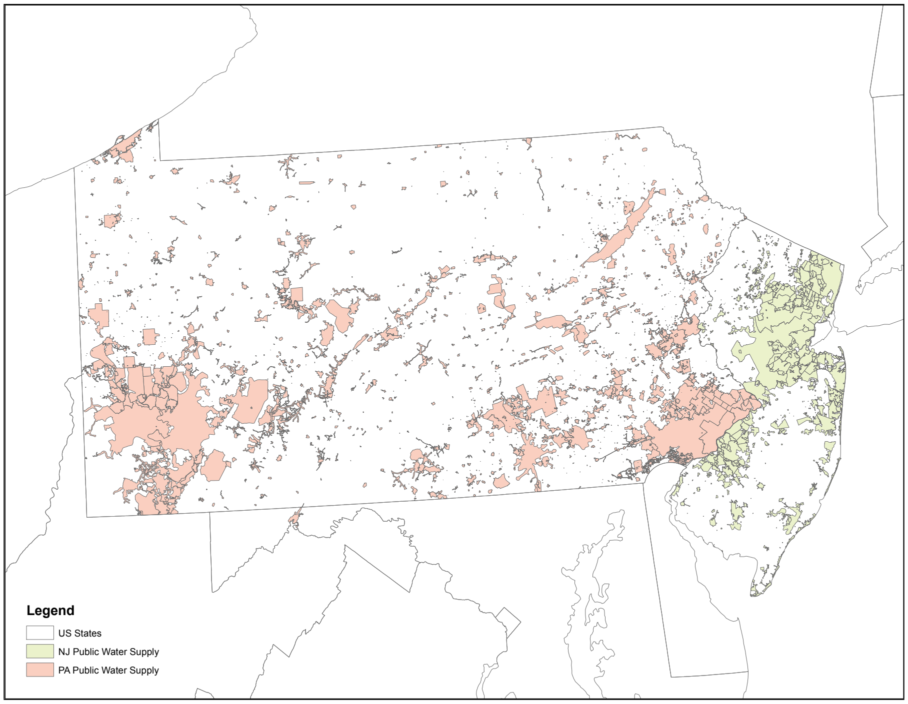
Newspaper Data

Information on newspaper coverage of leaking tanks comes from Access World News, a comprehensive collection of full-text news sources with over 528 million current and archived news articles from as early as 1978. Access World News provides extensive coverage at every geographic level, including many hard-to-find local and regional sources that are unavailable elsewhere. This access to local news articles is crucial for determining information available to mothers about local leaking underground tanks. News articles containing the phrase "leaking underground tank" are considered coverage of a nearby leak site. Other key words, such as "underground storage tank leak", or inclusion of additional terms such as "water", produce similar results. Newspaper articles for a 9 month gestation period are linked to mothers based on county of residence and month of conception. I create an indicator for any newspaper coverage during the fixed, hypothetical 9 month period of gestation.

Census Data

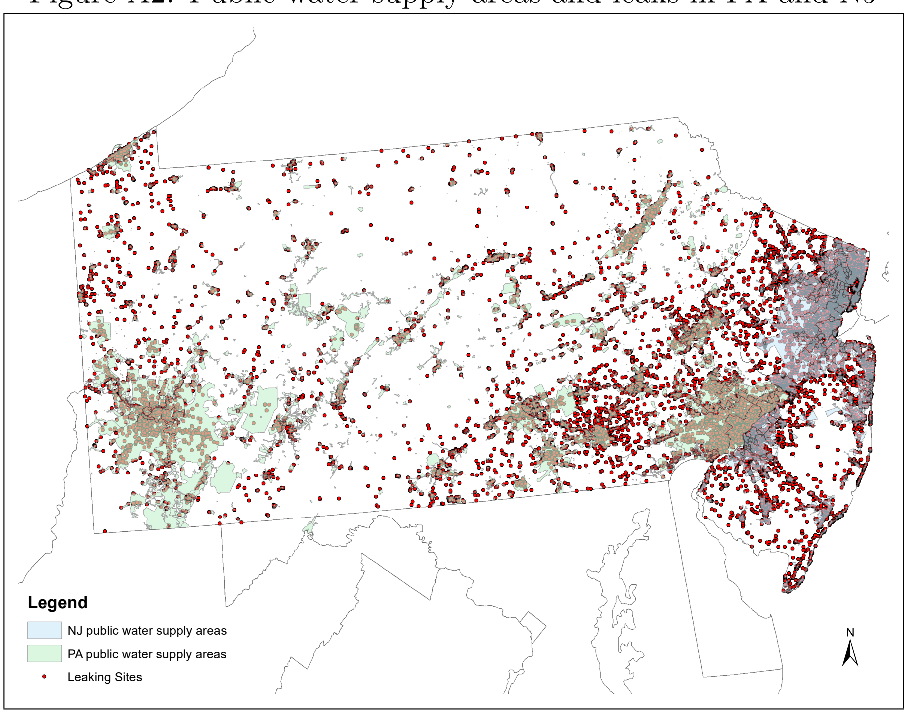
Tract level data from the 2000 Census provide further information on the neighborhood characteristics. Variables of interest include median house value, median income, unemployment rate, poverty rate, percent foreign, and percent renters.

Figure A1: Public water supply areas in PA and NJ



Notes: Community water service area boundaries for New Jersey come from the NJ DEP (Carter et al., 2004). The PA DEP provides a digitized map of the boundaries of the current public water supplier's (PWS) service areas (PADEP, 2015).

Figure A2: Public water supply areas and leaks in PA and NJ



Notes: Community water service area boundaries for New Jersey come from the NJ DEP (Carter et al., 2004). The PA DEP provides a digitized map of the boundaries of the current public water supplier's (PWS) service areas (PADEP, 2015).

Table A1: PWS water quality VOC violations

VOCs	Number of violations	Percent of violations	Avg. Duration (months)	MCL (mg/L)
BENZENE	29	3.97	3.62	0.005
CARBON TETRACHLORIDE	8	1.10	2.88	0.005
o-DICHLOROBENZENE	0	0.00		0.600
PARA-DICHLOROBENZENE	1	0.14	3.00	0.075
1,2-DICHLOROETHANE	12	1.64	3.00	0.005
1,1-DICHLOROETHYLENE	93	12.74	3.29	0.007
cis-1,2-DICHLOROETHYLENE	19	2.60	3.47	0.070
trans-1,2-DICHLOROETHYLENE	4	0.55	3.00	0.100
DICHLOROMETHANE	11	1.51	4.64	0.005
1,2-DICHLOROPROPANE	5	0.68	3.00	0.005
ETHYLBENZENE	1	0.14	3.00	0.700
MONOCHLOROBENZENE	0	0.00		0.100
STYRENE	0	0.00		0.100
TETRACHLOROETHYLENE	153	20.96	3.82	0.005
TOLUENE	0	0.00		1.00
1,2,4-TRICHLOROBENZENE	0	0.00		0.070
1,1,1-TRICHLOROETHANE	31	4.25	3.00	0.200
1,1,2-TRICHLOROETHANE	15	2.05	3.00	0.005
TRICHLOROETHYLENE	316	43.29	3.07	0.005
VINYL CHLORIDE	30	4.11	3.00	0.002
XYLENES (Total)	0	0.00		10.00

Notes: Maximum Contaminant Levels (MCLs) as of April 2006 and MCL violation data were obtained from the Pennsylvania Department of Environmental Protection, Division of Drinking Water Management.

Regulation History

Table A2: History of UST Regulation

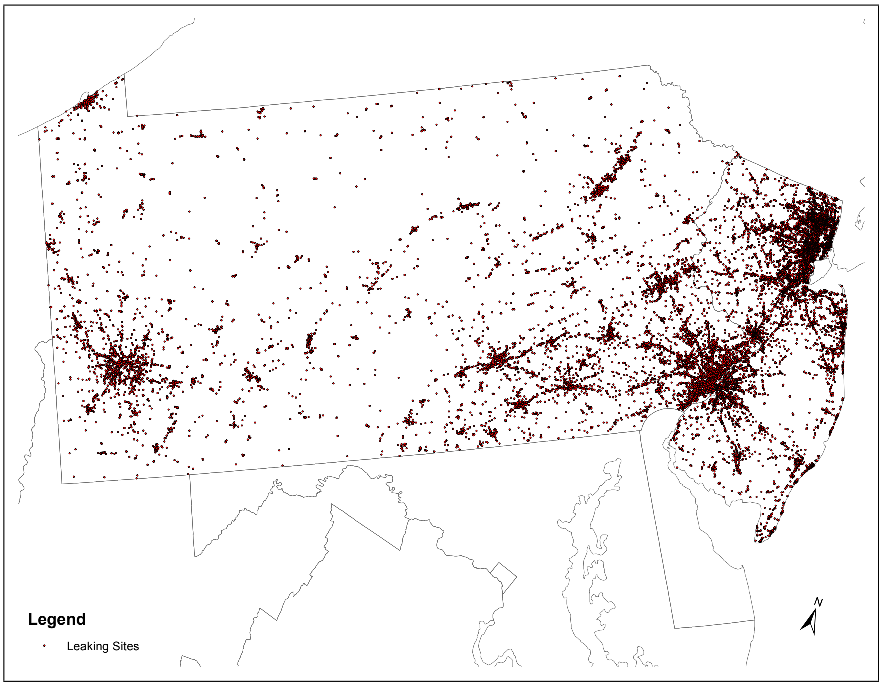
1984	Subtitle I added to the Solid Waste Disposal Act (SWDA) through the Hazardous and Solid Waste Amendments • Created a federal program to regulate USTs containing petroleum and certain hazardous chemicals • Directed EPA to set operating requirements and technical standards
1986	Subtitle I amended through the Superfund Amendments Reauthorization Act • Authorized EPA to respond to petroleum spills and leaks • Directed EPA to establish financial responsibility requirements of UST owners • Created a Leaking Underground Storage Tank (LUST) Trust Fund (to oversee and enforce cleanups, and to pay for cleanups when the owner or operator is unknown, unwilling, or unable to respond or when emergency action is required)
1988	EPA issues UST Regulations • Technical standards require leak detection, leak prevention, and corrective action • New tanks must meet all technical standards, but tanks installed prior to December 22, 1988 have until December 22, 1998 to be upgraded, replaced, or closed • Requires all UST owners and operators to demonstrate financial responsibility for taking corrective action, and for compensating thrid parties for bodily injury and property damage from releases
2005	Energy Policy Act of 2005 amended Subtitle I of the SWDA • Added new leak detection and enforcement provisions • Required all regulated USTs to be inspected every 3 years • Expanded use of the LUST Trust Fund
2009	American Recovery and Reinvestment Act of 2009 • Provided a one-time supplemental appropriation of $200 million from the LUST Trust Fund to EPA for cleaning up leaks from federally regulated USTs
2015	The 2015 UST Regulation updated the 1988 UST Regulation • Added periodic operation and maintenance requirements for UST systems • Added requirements to ensure UST compatibility before storing certain biofuel blends • Removed past deferrals for emergency generator tanks, airport hydrant systems, and field-constructed tanks • Expanded coverage of the regulation to Indian country

Source: EPA's Office of Underground Storage Tanks: www.epa.gov/ust.

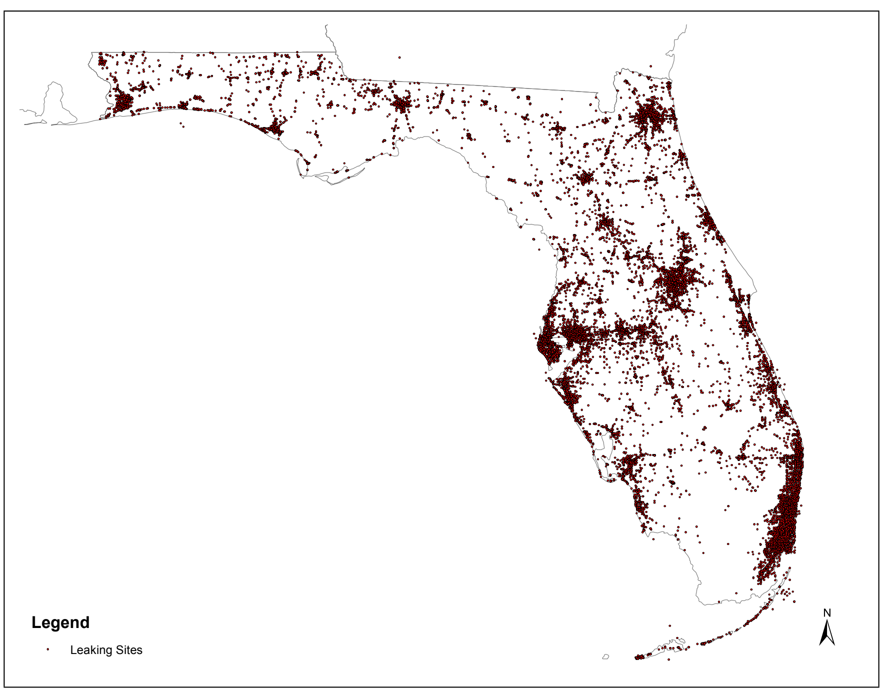
Additional Figures & Tables

Figure A3: Leaking underground storage tanks

(a) Pennsylvania and New Jersey

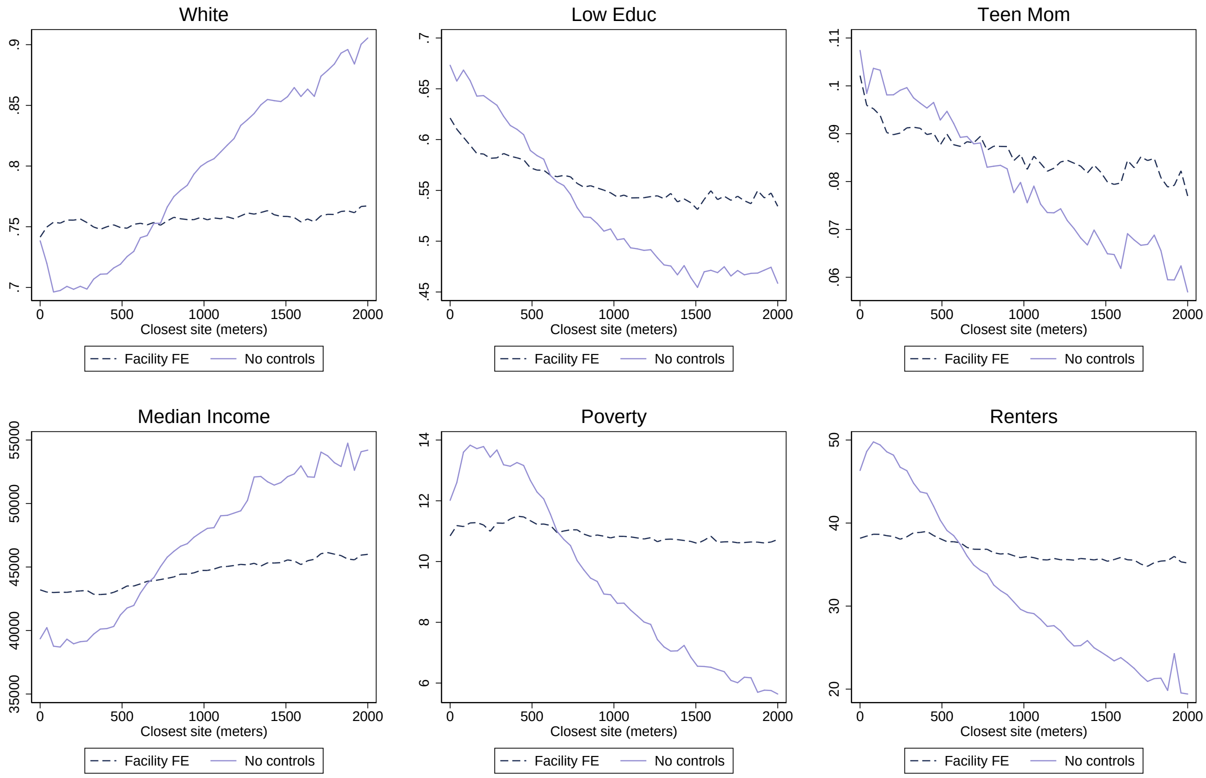


(b) Florida



Notes: Figures show location of all facilities that ever report a leak.

Figure A4: Demographic gradients controlling for facility fixed effect



Notes: Pre-1998 maternal characteristics by distance, smoothed using "lpoly" (degree 0, bandwidth 15). Includes mothers who live near a site that leaked.

Table A3: Demographic gradients controlling for facility fixed effect

	(1) Black	(2) Black	(3) Low Educ	(4) Low Educ	(5) Teen Mom	(6) Teen Mom
Distance	-0.109***	-0.00955***	-0.132***	-0.0700***	-0.0250***	-0.0135***
	(0.000597)	(0.00218)	(0.000738)	(0.00204)	(0.000421)	(0.000750)
Observations	2,282,224	2,279,744	2,240,436	2,237,961	2,283,129	2,280,647
R-squared	0.014	0.418	0.014	0.154	0.002	0.054
Facility FE		yes		yes		yes

Notes: Coefficients and standard errors are scaled by 1000. Distance is measured in meters to the closest tank that experienced a leak. Standard errors are clustered by facility when facility fixed effects are included. p<0.01, p<0.05, p<0.1

Table A4: Summary statistics: Mothers living near USTs

	Distance from leaking UST			
	<300m	300-600m	>600m	Total
Age	27.22	27.52	28.36	27.98
	(6.102)	(6.138)	(6.059)	(6.103)
Smoker	0.145	0.136	0.115	0.125
	(0.352)	(0.343)	(0.319)	(0.331)
Married	0.542	0.578	0.686	0.637
	(0.498)	(0.494)	(0.464)	(0.481)
Hispanic	0.362	0.385	0.422	0.404
	(0.480)	(0.487)	(0.494)	(0.491)
White	0.687	0.695	0.796	0.754
	(0.464)	(0.460)	(0.403)	(0.430)
Black	0.243	0.240	0.156	0.190
	(0.429)	(0.427)	(0.362)	(0.392)
< HS	0.0559	0.0435	0.0316	0.0382
	(0.230)	(0.204)	(0.175)	(0.192)
Some HS	0.165	0.150	0.110	0.128
	(0.372)	(0.357)	(0.313)	(0.334)
HS Grad	0.363	0.346	0.306	0.325
	(0.481)	(0.476)	(0.461)	(0.468)
Some College	0.198	0.216	0.247	0.232
	(0.398)	(0.411)	(0.431)	(0.422)
College Grad	0.122	0.144	0.192	0.170
	(0.327)	(0.351)	(0.394)	(0.375)
College+	0.0632	0.0754	0.0980	0.0871
	(0.243)	(0.264)	(0.297)	(0.282)
Prenatal Visits	10.47	10.76	11.35	11.07
	(4.054)	(4.027)	(3.829)	(3.928)
Observations	1,477,344	2,412,394	5,854,076	9,743,814

Notes: Average characteristics of mothers with standard deviations in parentheses. Distance (in meters) is measured with respect to the nearest leaking underground storage tank. Observations include all mothers with each distance range.

Table A5: Select chemicals found in underground storage tanks

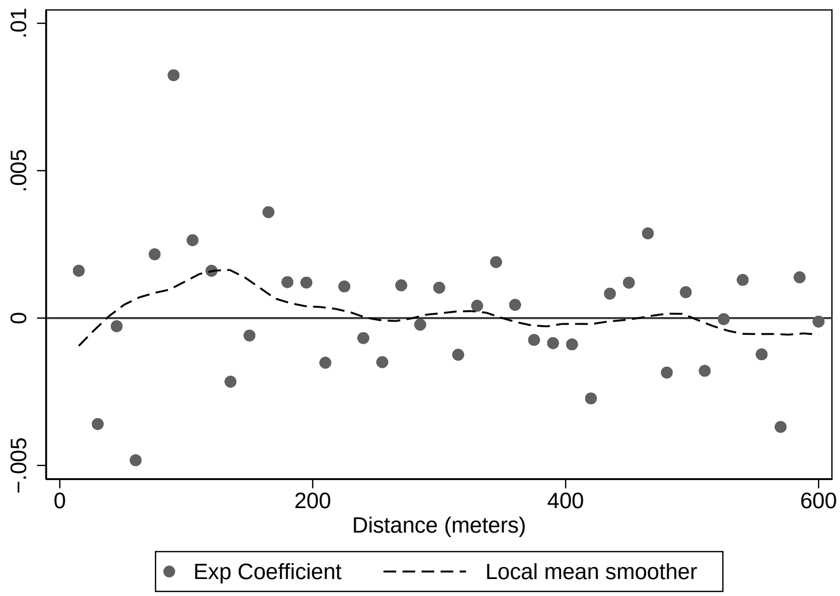
			Odor threshold					
	Color	Odor	Water	Air	Taste threshold	Class	MCLG	MCL
Benzene	Clear/colorless	Aromatic	2.0 mg/L	34 - 119 mg/L	0.5 - 4.5 mg/L	VOC	0 mg/L	0.005 mg/L
Toluene	Colorless	Sweet, pungent	0.024 - 0.17 mg/L	2.14 mg/L	No data	VOC	1 mg/L	1 mg/L
Xylenes (mixed)	Clear	Sweet	No data	1.0 mg/L	No data	VOC	10 mg/L	10 mg/L
Ethylbenzene	Colorless	Sweet, gasoline-like	0.029 - 0.140 mg/L	2.3 mg/L	No data	VOC	0.7 mg/L	0.7 mg/L
MTBE	Colorless	Terpene-like	680 ppb	No data	No data	Oxygenate		
Naphthalene	White	Tar, mothballs	0.021 mg/L	0.44 mg/m^3	No data	PAH		
1,2 Dichloroethane	Colorless	Pleasant odor	20 mg/L	12 - 100 mg/L	No data	VOC	0 mg/L	0.005 mg/L

Notes: The Maximum Contaminant Level Goal (MCLG) is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals. The Maximum Contaminant Level (MCL) is the highest level of a contaminant that is allowed in drinking water and is an enforceable standard. MCLGs and MCLs are from the EPA's National Primary Drinking Water Regulations.

Source: Toxicological profiles, Agency for Toxic Substance & Disease Registry.

[a] Solubility in water at 20°C

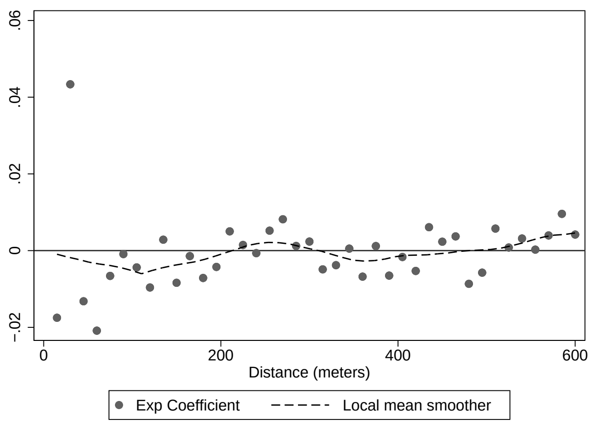
Figure A5: Time-varying maternal characteristics by exposure and distance: Predicted Index



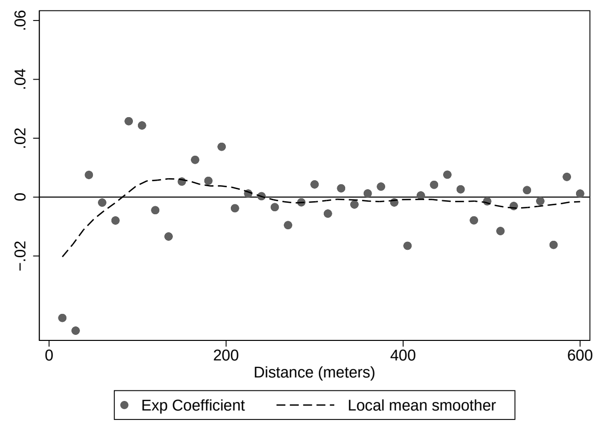
Notes: Plots point estimates of gestational leak exposure for each of 40 distance bins after controlling for age, parity, year, month, and maternal fixed effects. The local mean smoother uses “lpoly” with degree of 0 and bandwidth of 35. Sample includes births occurring before the 1998 regulations.

Figure A6: Time-varying maternal characteristics by exposure and distance

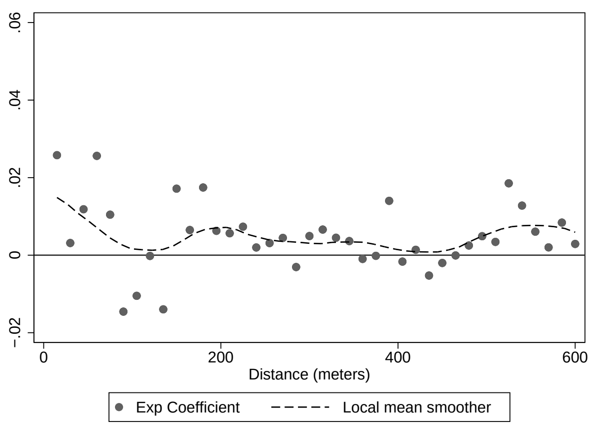
(a) Smoking



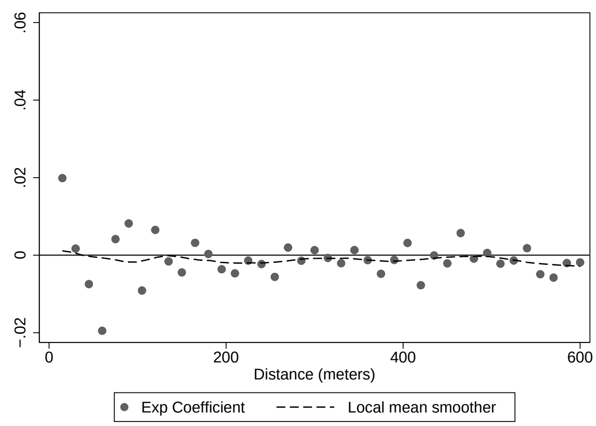
(c) Risky



(b) Unmarried



(d) No Prenatal Visits



Notes: Plots point estimates of gestational leak exposure for each of 40 distance bins after controlling for age, parity, year, month, and maternal fixed effects. The local mean smoother uses "lpoly" with degree of 0 and bandwidth of 35. Sample includes births occurring before the 1998 regulations.

Table A6: Health impact of leak exposure by alternate distances

	Low Birth Weight				
Near:	<100m	<200m	<300m	<400m	<500m
	(1)	(2)	(3)	(4)	(5)
Near × Exp	0.902*	0.832***	0.471**	0.328*	-0.0453
	(0.513)	(0.262)	(0.189)	(0.173)	(0.233)
Observations	758,298	758,298	758,298	758,298	758,298
Number of Moms	342,912	342,912	342,912	342,912	342,912
Outcome Mean	0.0666	0.0666	0.0666	0.0666	0.0666
% Change	13.5	12.5	7.07	4.92	-0.680

Notes: For all columns the control group includes individuals within 1000m of a leak site, rather than within 600m as shown in the main results. Coefficients and standard errors scaled by 100. Each regression includes maternal and child controls, year dummies, month dummies, and maternal fixed effects. The sample is restricted births occurring before the 1998 UST regulation deadline. *** p<0.01, ** p<0.05, * p<0.1

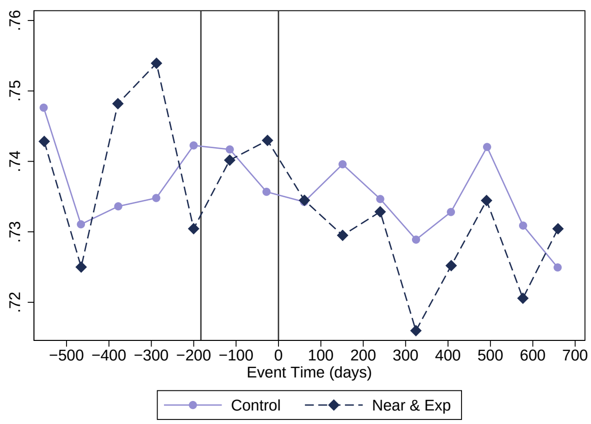
Table A7: Health impact of leak exposure: Non-PWS area robustness

	Index Z	Low BW	Preterm	APGAR	Cong.Anom.	Abnorm
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Days Exposed						
Near×Exp×PWS	0.0122**	0.00622**	0.00443	0.000130	0.00117	0.00126
	(0.00613)	(0.00265)	(0.00292)	(0.00862)	(0.00115)	(0.00121)
Near×Exp×Non-PWS	0.0271**	0.0138***	0.0131***	-0.0116	0.00148	0.00279
	(0.0110)	(0.00442)	(0.00478)	(0.0153)	(0.00236)	(0.00233)
Equality test	0.110	0.0362	0.0230	0.359	0.883	0.447
Panel B. Exposure Dummy						
Near×Exp×PWS	2.786*	1.462**	1.436**	0.239	0.209	0.420
	(1.444)	(0.631)	(0.688)	(2.029)	(0.267)	(0.283)
Near×Exp×Non-PWS	5.830**	2.997***	3.257***	-3.493	0.197	0.705
	(2.606)	(1.063)	(1.140)	(3.503)	(0.546)	(0.556)
Equality test	0.167	0.0777	0.0477	0.199	0.980	0.558
Observations	475,470	474,676	475,470	471,516	475,470	475,470
Number of Moms	212,395	212,074	212,395	210,950	212,395	212,395
PWS Mean	-0.00676	0.0691	0.0809	9.014	0.0129	0.0147
Non-PWS Mean	-0.0519	0.0435	0.0527	9.041	0.0134	0.0136
% Change PWS	-	21.2	17.7	0.0265	16.2	28.6
% Change Non-PWS	-	69.0	61.7	-0.386	14.7	51.7

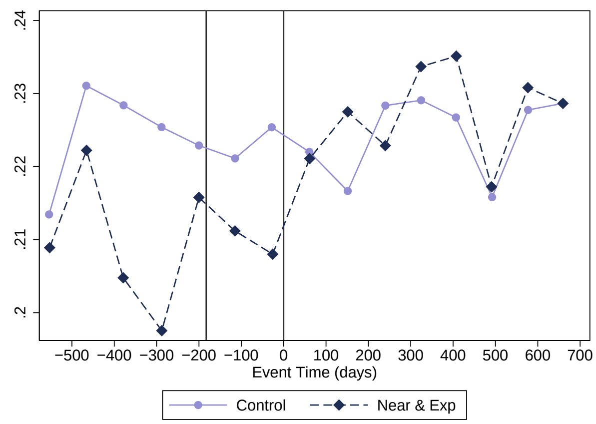
Notes: Sample is restricted to mothers living in Pennsylvania and New Jersey. Coefficients and standard errors scaled by 100. Specification controls for a differential baseline impact of exposure for mothers inside and outside PWS areas. Each regression includes maternal and child controls, year dummies, month dummies, and maternal fixed effects. Additional controls include Near×Exp and Exp interacted with education, race, and smoking status. P-values are shown to test the equality of coefficient estimates for mothers inside and outside public water supply areas. *** p<0.01, ** p<0.05, * p<0.1

Figure A7: Event study of facility upgrades: mother characteristics

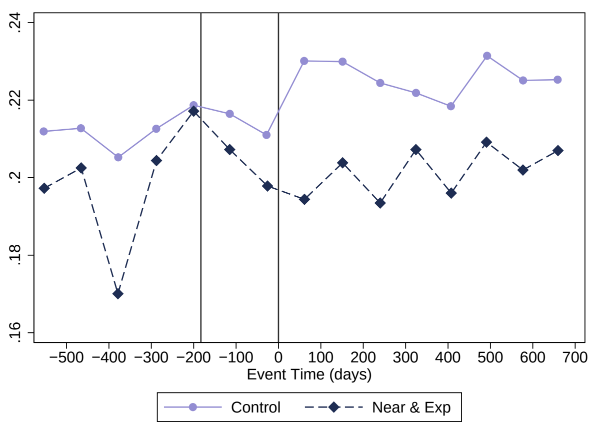
(a) White



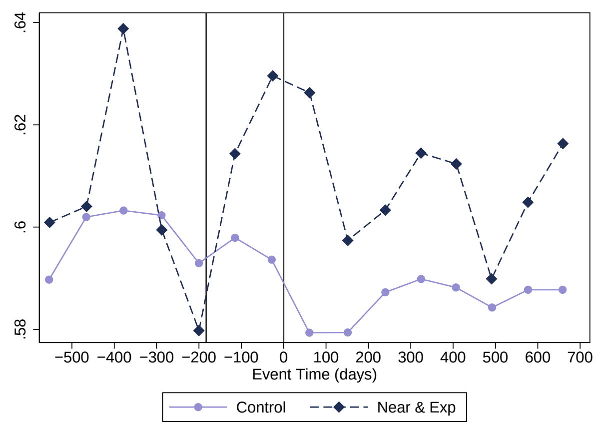
(d) Black



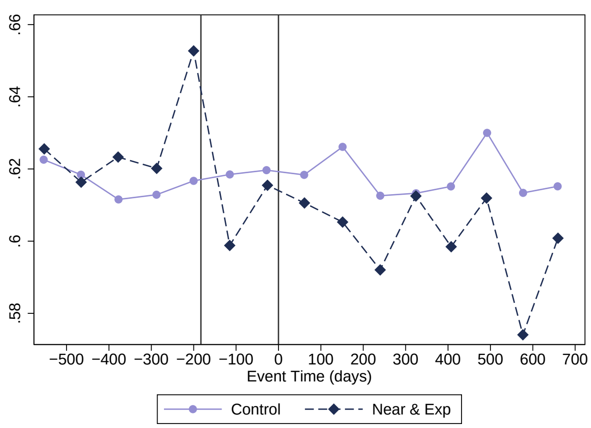
(b) High Educ



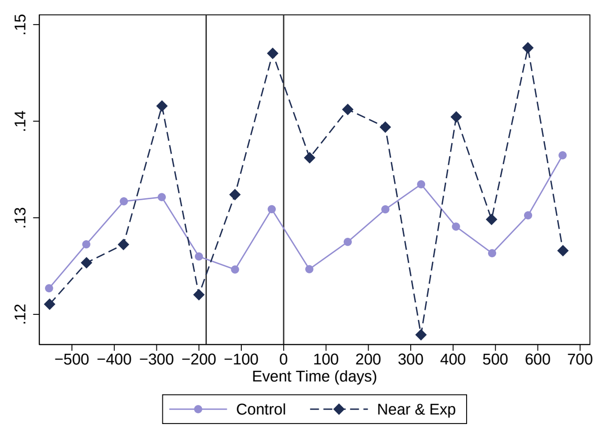
(e) Low Educ



(c) Married

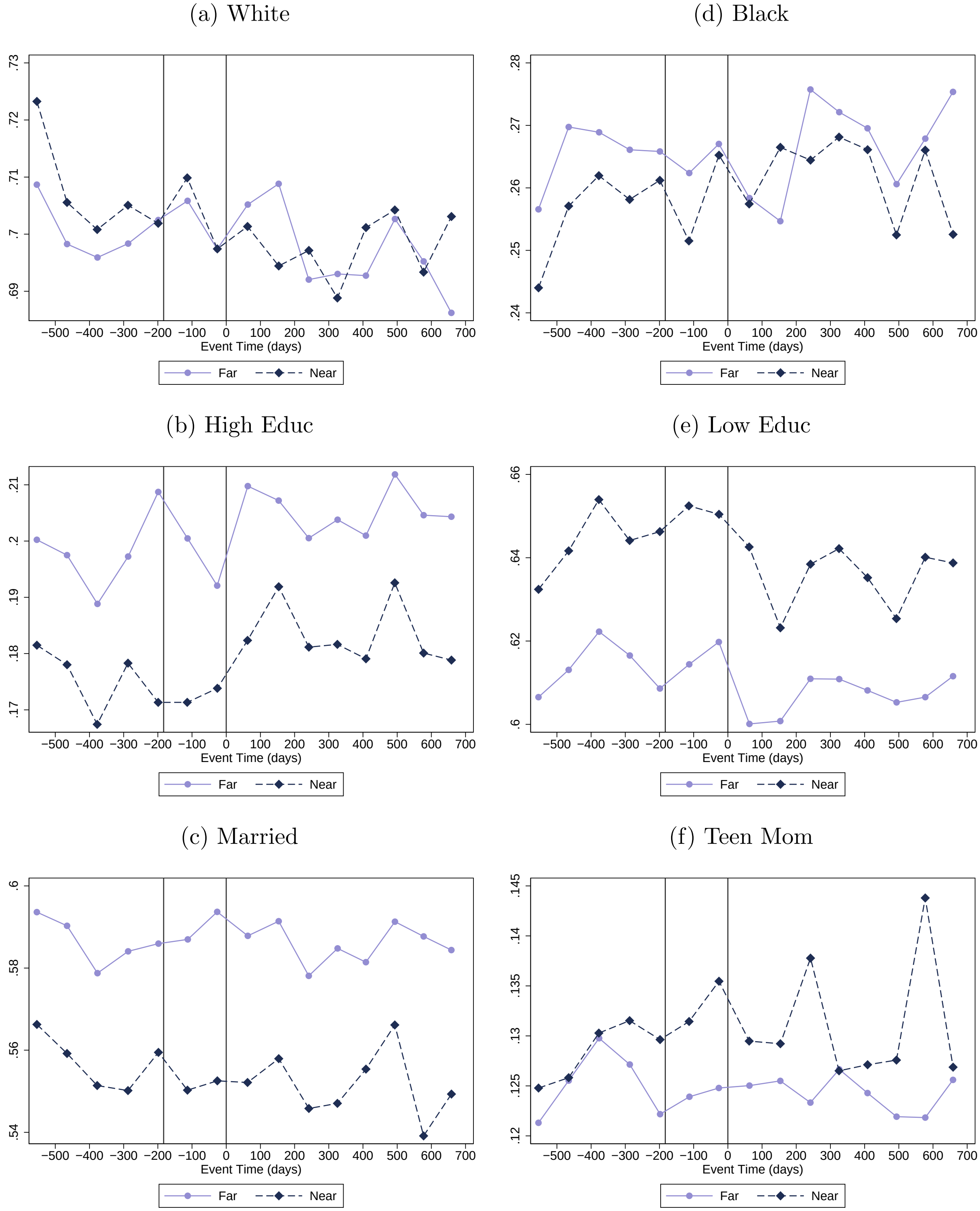


(f) Teen Mom



Notes: Event time (in days) is calculated as the difference between the date of birth and the date of facility upgrade (defined in section 2). The first vertical line identifies the earliest time at which old tanks were removed (a half year) before the new tanks were installed at time 0, which is marked by the second vertical line. The diamonds represent individuals who live within 300m of the facility and were exposed to a leak. The control group includes individuals farther away (300-600m) or unexposed. The sample contains data from PA and FL and is limited to non-movers.

Figure A8: Event study of facility upgrades: all mothers near vs. far



Notes: Event time (in days) is calculated as the difference between the date of birth and the date of facility upgrade (defined in section 2). The first vertical line identifies the earliest time at which old tanks were removed (a half year) before the new tanks were installed at time 0, which is marked by the second vertical line. Near includes mothers living within 300m and far includes mothers 300-600m. The sample contains data from PA and FL and includes movers and non-movers.

Table A8: Bias with and without FE: Exposure analysis, all outcomes

	OLS (1)	OLS (2)	Facility FE (3)	Facility FE (4)	Mother FE (5)	Mother FE (6)
Panel A. Index Z						
Near × Exp	-0.524*	0.146	0.182	0.316	1.438***	1.472***
	(0.297)	(0.294)	(0.338)	(0.333)	(0.482)	(0.482)
Panel B. Low birth weight						
Near × Exp	-0.371***	-0.0666	-0.0675	-0.00981	0.576***	0.586***
	(0.129)	(0.127)	(0.145)	(0.141)	(0.205)	(0.205)
Panel C. Preterm birth						
Near × Exp	-0.136	0.275*	0.153	0.225	0.659***	0.676***
	(0.151)	(0.149)	(0.170)	(0.167)	(0.244)	(0.244)
Panel D. APGAR score						
Near × Exp	-0.157	-0.887**	-0.225	-0.367	-1.160*	-1.188*
	(0.398)	(0.395)	(0.445)	(0.441)	(0.661)	(0.659)
Panel E. Congenital anomalies						
Near × Exp	0.00347	0.00490	0.0296	0.0327	0.0681	0.0691
	(0.0502)	(0.0502)	(0.0556)	(0.0556)	(0.0891)	(0.0891)
Panel F. Abnormal conditions						
Near × Exp	-0.0203	0.0190	0.0784	0.0852	0.118	0.119
	(0.0667)	(0.0666)	(0.0713)	(0.0711)	(0.110)	(0.110)
SE Cluster Level			Facility	Facility	Mother	Mother
Controls	no	yes	no	yes	no	yes

Notes: Exposure is measured as a binary variable based on a hypothetical 39 week gestation. All specifications include year and month dummies. Columns including controls also include indicators for missing values for gender, education, marriage and smoking status. Standard errors are in parentheses. Coefficients and standard errors scaled by 100. *** p<0.01, ** p<0.05, * p<0.1

Table A9: Bias with and without FE: Regulation analysis

	Low Birth Weight					
	OLS	OLS	Facility FE	Facility FE	Mother FE	Mother FE
	(1)	(2)	(3)	(4)	(5)	(6)
Near×Exp×Reg	-0.939***	-0.880***	-0.813***	-0.785***	-1.057*	-1.044*
	(0.210)	(0.207)	(0.229)	(0.226)	(0.540)	(0.539)
Near×Exp	0.422***	0.524***	0.492***	0.479***	0.935**	0.891**
	(0.156)	(0.154)	(0.173)	(0.170)	(0.443)	(0.442)
Exp×Reg	0.534***	0.423***	0.0562	0.150	0.770**	0.789***
	(0.118)	(0.118)	(0.139)	(0.137)	(0.304)	(0.303)
Near×Reg	0.235*	0.232*	0.247*	0.233*	0.307	0.265
	(0.129)	(0.128)	(0.141)	(0.139)	(0.374)	(0.373)
Exp	-0.358***	-0.371***	-0.143	-0.264**	-0.589**	-0.585**
	(0.0882)	(0.0891)	(0.114)	(0.112)	(0.250)	(0.250)
Reg	-0.0714	-0.0873	0.0404	-0.0484	-0.427	-0.445*
	(0.0984)	(0.0978)	(0.132)	(0.128)	(0.271)	(0.270)
Near	0.175**	-0.0163	0.0580	-0.00722		
	(0.0892)	(0.0882)	(0.101)	(0.0978)		
Observations	1,161,071	1,161,071	1,161,071	1,161,071	1,161,071	1,161,071
R-squared	0.000	0.021	0.0227	0.0360	0.859	0.860
Controls	no	yes	no	yes	no	yes
Number of FE			17,374	17,374	928,473	928,473

Notes: Exposure is measured as a binary variable based on a hypothetical 39 week gestation. All specifications include year and month dummies. Columns with controls include child gender, parity indicators, maternal education, marital status, smoking status, age, age-squared, indicators for race, and indicators for missing values of gender, education, marriage and smoking status. Standard errors are in parentheses. Coefficients and standard errors scaled by 100. *** p<0.01, ** p<0.05, * p<0.1

Table A10: Bias with and without FE: Regulation analysis, all outcomes

	OLS (1)	OLS (2)	Facility FE (3)	Facility FE (4)	Mother FE (5)	Mother FE (6)
Panel A. Index Z						
Near × Exp × Reg	-1.188***	-1.107**	-1.151**	-1.132**	-1.807	-1.783
	(0.453)	(0.450)	(0.491)	(0.484)	(1.228)	(1.226)
Panel B. Low birth weight						
Near × Exp × Reg	-0.939***	-0.880***	-0.813***	-0.785***	-1.057*	-1.044*
	(0.210)	(0.207)	(0.229)	(0.226)	(0.540)	(0.539)
Panel C. Preterm birth						
Near × Exp × Reg	-0.713***	-0.597**	-0.505*	-0.511*	-0.287	-0.293
	(0.249)	(0.247)	(0.268)	(0.263)	(0.670)	(0.669)
Panel D. APGAR score						
Near × Exp × Reg	0.648	0.475	0.285	0.221	2.827*	2.839*
	(0.612)	(0.608)	(0.663)	(0.656)	(1.690)	(1.687)
Panel E. Congenital anomalies						
Near × Exp × Reg	0.0156	-0.0102	-0.0386	-0.0448	0.0338	0.0356
	(0.0744)	(0.0744)	(0.0776)	(0.0774)	(0.225)	(0.224)
Panel F. Abnormal conditions						
Near × Exp × Reg	0.0134	0.0205	-0.108	-0.102	0.140	0.144
	(0.132)	(0.132)	(0.146)	(0.146)	(0.373)	(0.373)
SE Cluster Level			Facility	Facility	Mother	Mother
Controls	no	yes	no	yes	no	yes

Notes: Exposure is measured as a binary variable based on a hypothetical 39 week gestation. All specifications include year and month dummies. Columns including controls also include indicators for missing values for gender, education, marriage and smoking status. Standard errors are in parentheses. Coefficients and standard errors scaled by 100. *** p<0.01, ** p<0.05, * p<0.1

Table A11: Robustness to interaction with parity indicators

	Low Birth Weight					
Parity X =	1^{st}	2^{nd}	3^{th}	4^{th}	5^{th}	$6^{th}+$
	(1)	(2)	(3)	(4)	(5)	(6)
Near × Exp × Parity X	-0.0623	-0.156	0.224	-0.269	0.717	1.253
	(0.207)	(0.182)	(0.253)	(0.422)	(0.754)	(0.999)
Near × Exp	0.617***	0.657***	0.553***	0.624***	0.575***	0.561***
	(0.214)	(0.220)	(0.215)	(0.209)	(0.207)	(0.207)
Observations	693,159	693,159	693,159	693,159	693,159	693,159
Number of Moms	311,040	311,040	311,040	311,040	311,040	311,040

Table A12: Health impact of leak exposure: Non-movers only

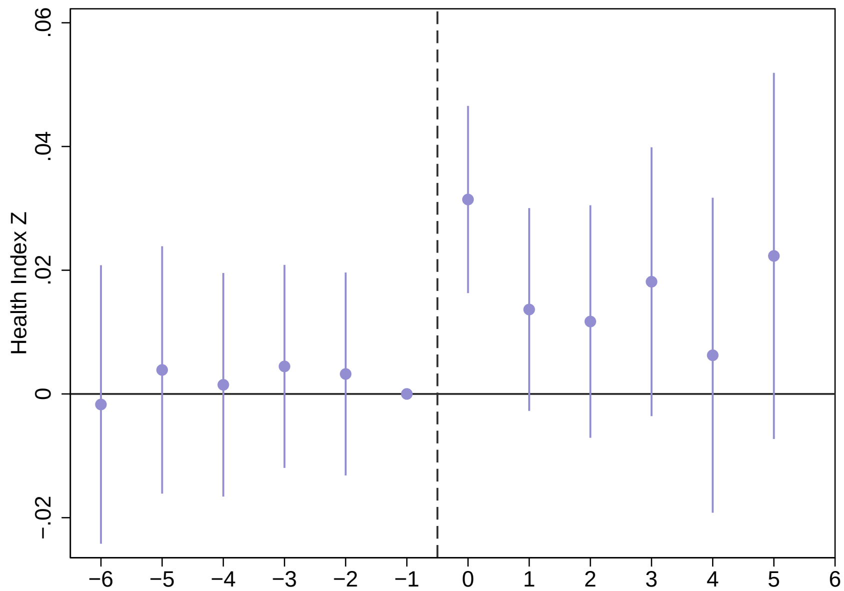
	Index Z	Low BW	Preterm	APGAR	Cong.Anom.	Abnorm
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Days Exposed						
Near×Exp	0.00564**	0.00236**	0.00206*	-0.00847***	0.000182	0.000257
	(0.00235)	(0.000994)	(0.00119)	(0.00322)	(0.000438)	(0.000520)
Panel B. Exposure Dummy						
Near×Exp	1.418**	0.580**	0.693**	-1.378*	0.0627	0.0558
	(0.560)	(0.239)	(0.284)	(0.768)	(0.103)	(0.123)
Observations	399,359	398,796	399,359	395,845	399,359	399,359
Number of Moms	186,465	186,219	186,465	185,018	186,465	186,465
% Change	-	8.57	7.56	-0.153	5.74	3.17

Notes: Shows results from estimation of equation 2. Coefficients and standard errors scaled by 100. Each regression includes maternal and child controls, year dummies, month dummies, and maternal fixed effects. The sample is restricted to non-movers and births occurring before the 1998 UST regulation deadline. *** p<0.01, ** p<0.05, * p<0.1

Table A13: Placebo tests

	Placebo Distance: 900-1200m vs. 1200-1500m			Placebo Outcome: Birth Injury
	Index Z	Low BW	Preterm	
	(1)	(2)	(3)	(4)
Near × Exp	0.377	-0.0343	0.401	-0.0216
	(0.495)	(0.206)	(0.253)	(0.0337)
Observations	270,073	269,816	270,073	694,033
Number of Moms	125,649	125,538	125,649	311,395

Figure A9: Timing relative to leak start date



Notes: Plots coefficients and 90% confidence intervals from a single regression for individuals living near the leak in periods before and after the leak start date. Each coefficient represents a period of 365 days relative to leak start date. Includes controls for maternal and child characteristics, mother fixed effects, year dummies, period dummies, and month dummies. Sample includes births occurring before the 1998 regulations.

Table A14: Health impact of leak exposure: Urban vs. Rural

	Index Z (1)	Low BW (2)	Preterm (3)	APGAR (4)	Cong. Anom. (5)	Abnorm (6)
Panel A. Days Exposed						
Near×Exp×Urban	0.00415	0.00159	0.000940	-0.000642	0.000400	0.000202
	(0.00343)	(0.00153)	(0.00180)	(0.00476)	(0.000597)	(0.000713)
Near×Exp×Rural	0.00624***	0.00262***	0.00240**	-0.00843***	0.000237	0.000605
	(0.00227)	(0.000930)	(0.00113)	(0.00307)	(0.000428)	(0.000546)
Equality test	0.582	0.531	0.458	0.133	0.806	0.626
Panel B. Exposure Dummy						
Near×Exp×Urban	0.891	0.174	0.329	0.125	0.122	0.0761
	(0.813)	(0.365)	(0.427)	(1.135)	(0.140)	(0.170)
Near×Exp×Rural	1.844***	0.770***	0.772***	-2.061***	0.0696	0.156
	(0.547)	(0.225)	(0.272)	(0.737)	(0.103)	(0.131)
Equality test	0.290	0.129	0.342	0.0776	0.740	0.684
Observations	692,463	691,590	692,463	687,293	692,463	692,463
Number of Moms	310,725	310,370	310,725	308,815	310,725	310,725
Rural Mean	-0.00629	0.0626	0.0877	8.985	0.0105	0.0198
Urban Mean	0.0226	0.0873	0.108	8.999	0.00977	0.0147
% Change Rural	-	0.123	0.0881	-0.00229	0.0665	0.0790
% Change Urban	-	0.0199	0.0306	0.000139	0.125	0.0517

Note: "Urban" areas are defined as those with both population density and the percent renters above the 75th percentile, based on census tract level data from the 2000 Census. "Rural" areas are defined as all other areas.