DEP Sampling Study at USA TODAY Report Sites

Iroquois Junior-Senior High School, Erie, Pennsylvania

Background

In response to a USA TODAY special report titled "The Smokestack Effect – Toxic Air and America's Schools", the Pennsylvania Department of Environmental Protection (DEP), Bureau of Air Quality (BAQ) conducted air sampling for toxic pollutants at a select group of schools in Pennsylvania. The schools were chosen based on their modeled relative ranking above the reference school (Meredith Hitchens Elementary School in Ohio) cited in the report. Additional schools were chosen where USA TODAY conducted their own sampling and risk analysis, and proposed the school required further investigation.

The Iroquois Junior-Senior High School was one of 38 schools in Pennsylvania where the modeled ranking was above the reference school and in the top 1% of all schools in the United States. The model listed manganese, chromium, nickel and 1,2,4-trimethylbenzene as the major pollutants of concern at this site. No sampling was done by USA TODAY at the school to confirm the modeling results. See USA TODAY's information on their website at http://smokestack.usatoday.com/.

Findings

The total excess lifetime cancer risk based on DEP sampling is 6.8 in a 100,000. The risk calculation assumes an adult weighing 70 kilograms (154 pounds) will breathe 20 m^3 (706 ft^3) of air each day for 365 days a year, over a 70-year lifetime of exposure. This level of cancer risk falls within the US Environmental Protection Agency's (EPA) generally acceptable risk range of 1-in-10,000 to 1-in-a-million. This differs from the USA TODAY's determination through modeling that toxic pollution levels may be unacceptable.

Because the DEP sampling found the concentrations of the pollutants measured at this site to be below non-cancer health benchmarks, non-cancer health effects are not expected from breathing the air at this school.

DEP Sampling

Two types of air sampling were conducted at the Iroquois High School. One type sampled for concentrations of toxic metals in particles including arsenic, beryllium, cadmium, chromium, lead, manganese, nickel and zinc. The other type of sampling looked for concentrations of volatile organic compounds (VOCs) and naphthalene. The DEP laboratory conducts a "blanket" analysis of 57 target VOCs which include 34 "Hazardous Air Pollutants" listed in the 1990 Clean Air Act Amendments and additional compounds emitted by a wide variety of industries, motor vehicles and other sources. Another lab, Test America, was hired to analyze canisters for concentrations of naphthalene.

The toxic metals samples were collected over a 96-hour period using a high-volume particulate sampler with quartz-fiber filters, and were analyzed by the DEP Laboratory. The procedure is based on the Environmental Protection Agency's (EPA) Compendium Methods IO-2 and IO-3.

The VOC and naphthalene sampling used evacuated stainless steel canisters that were analyzed by the DEP and Test America laboratories. The procedure is based on EPA Compendium Method TO-15. The VOC samples were 24-hours in duration.

The DEP laboratory can detect very low levels of pollutants in the range well below 1 microgram (µg)(one millionth of a gram) per cubic meter (m^3) of air.

Summarizing the Data

In summarizing the sampling data, DEP calculated average concentrations from four samples for each toxic metal compound. If a compound was not detected, or found at a concentration below the Reporting Limit (RL) in all four samples, an average was not calculated. If a compound was detected in at least one sample, the average was calculated using ½ the lab RL for any non-detects.

Similarly for VOCs and naphthalene, if a compound was not detected, or found at a level below the Method Detection Limit (MDL) in all samples that were collected, an average was not calculated and the risk not determined. If a compound was detected in at least one sample, the average was calculated using ½ the lab MDL for any non-detects, and the risk was then determined.

Note that there are neither state nor national air quality standards for most of these pollutants (except for lead). Therefore, the DEP evaluated the health risks associated with breathing the measured concentrations of these pollutants using risk assessment methods approved by the EPA.

Overview of Risk Factors and Reference Doses

The excess lifetime cancer risk for each compound was calculated using unit risk factors (URFs), and the risk for non-cancer health effects was calculated using reference air concentrations (RfCs). The URF is a measure of the probability of developing cancer from exposure over a lifetime to a specified concentration of a given chemical. The RfC is the concentration below which no (non-cancer) adverse health affects are expected to occur over a lifetime of continuous exposure. The EPA Integrated Risk Information System (IRIS) database was the primary source for the risk factors. In some cases, there were no inhalation risk data for a chemical in the IRIS database, so other sources were referenced.

The URF and RfC are derived by assuming an adult weighing 70 kilograms (154 pounds) will breathe 20 m^3 (706 ft^3) of air each day for 365 days a year, over a 70-year lifetime of exposure.

The excess lifetime cancer risk is calculated for each compound by multiplying its URF by the average concentration. The individual risks for each chemical are added to get the total excess lifetime cancer risk at that site.

The excess lifetime cancer risk numbers are written in an exponential format (e.g. 1.0E-04). Refer to Table 1 when interpreting these numbers. For example, an excess lifetime cancer risk of 1.2E-05 means that 1.2 more people in a population of 100,000 (or 12 more in a million) are likely to develop cancer. This is above and beyond the national lifetime cancer risk of slightly less than 1 in 2 in men, and slightly more than 1 in 3 in women.

Table 1. Interpreting the risk numbers.

Risk	Exponential	Decimal	Read as…
1.0E-08	$1x10^{-8}$	0.00000001	1 in 100 million
1.0E-07	$1x10^{-7}$	0.0000001	1 in 10 million
1.0E-06	$1x10^{-6}$	0.000001	1 in 1 million
1.0E-05	$1x10^{-5}$	0.00001	1 in 100,000
1.0E-04	$1x10^{-4}$	0.0001	1 in 10,000

Any risk estimate is based on a number of assumptions and some of the assumptions DEP made for this study include:

- The average concentration of the samples collected is the concentration that the student will be exposed to over a lifetime;
- The concentrations measured at the sampling site are representative of exposures to the student population in the school;
- Hexavalent chromium (chrome VI) concentrations are assumed to be 1/7th the total chromium concentration;
- The effects of exposure to multiple chemicals are additive;
- The only excess risk considered in this report is due to inhalation.

The hazard quotient (non-cancer health risk) associated with each of the relevant compounds is calculated by simply dividing the compound average concentration by the respective RfC. The individual hazard quotients for each compound are summed to get the hazard index. If this value is less than one, and inhalation is the only source of exposure, then those chemicals concentrations are not likely to cause adverse non-cancer health affects.

Data Results

The results of air sampling by DEP can be found in Tables 2, 3 and 4, including results for the stated pollutants of concern (manganese, chromium, nickel and 1,2,4-trimethylbenzene). Of the four, three were detected in all samples (manganese, nickel and 1,2,4-trimethylbenzene). Chromium was only detected in one of four samples. Three of the 57 target VOC's are not included in Table 3 due to lab analysis problems with those compounds.

Because the USA Today listed naphthalene as a pollutant of concern at another Erie school (the Wayne Middle School on East Avenue), the DEP also looked for this compound in a portion of the samples collected. Naphthalene is not one of the 57 target VOCs that the DEP lab can quantify (i.e. produce an average concentration). Therefore, an outside lab, Test America, was contracted to provide this service.

Excess Lifetime Cancer Risk

The goal of Federal and State Air Pollution Agencies, when dealing with the emission of a toxic pollutant from an industrial source is to limit the risk from that pollutant to the surrounding community to less than one in a million excess lifetime cancer risk (from inhalation). The risk to communities is generally higher due to the fact there are multiple sources and multiple pollutants. In conducting risk assessments at hazardous waste cleanup projects and superfund sites, EPA generally considers a lifetime cancer risk to an individual of between 1-in-10,000 and 1-in-a-million as an acceptable range.

At the Iroquois Junior-Senior High School, the excess lifetime cancer risk for inhalation, based on the average concentration of toxic metals from DEP sampling, is 4.7 in a million (4.7E-06) and is shown in Table 2. The excess lifetime cancer risk for inhalation, based on the average concentration of VOC's from DEP sampling, is 4.5 in 100,000 (4.5E-05) and is shown in Table 3. The excess lifetime cancer risk for inhalation, based on the average concentration of naphthalene from DEP sampling, is 1.9 in 100,000 (1.9E-05) and is shown in Table 4.

The total excess lifetime cancer risk, which is calculated by summing the risk for metals, VOC's and naphthalene, is 6.8 in 100,000 (6.8E-05). This value falls between the 1-in-10,000 and 1-in-a-million range. With the conservative assumptions used by the DEP in conducting this risk assessment, the actual risk may be lower. For the purpose of comparison, Tables 2 and 3 also show the excess lifetime cancer risks for inhalation based on the 2007 average annual monitoring data from DEP air toxic monitors across the Commonwealth (a combination of rural and urban sites). The total risk of 6.8 in a 100,000 calculated for the Iroquois High School is in par with the combined statewide cancer risk for VOC's and toxic metals of 5.7 in 100,000, when factoring out the naphthalene risk.

The compounds producing most of the excess lifetime cancer risk are those that are typically found in urban industrialized settings like Erie, including benzene, carbon tetrachloride and trichloroethylene. Benzene emissions to the atmosphere can be attributed to gasoline vapors, auto exhaust, and its use as an intermediate in chemical production. In the past, carbon tetrachloride was used in the production of refrigeration fluid, propellants for aerosol cans, as well as many other uses. Because of its harmful effects, the chemical was banned in the 1970's and today, it is only used in some industrial applications. Because it is stable in air, a background concentration close to the sampling results still exists. Trichlorethylene is mainly used as a solvent to remove grease from metal parts.

Non-Cancer Health Effects

All toxic metals and VOCs and naphthalene measured had average concentrations below their respective RfC (a hazard quotient less than 1). Furthermore, the hazard index (the individual hazard quotients summed) was below 1 as well. Consequently, non-cancer health effects are not expected from breathing the air at the school.

The EPA has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, including lead, to protect public health and welfare. The NAAQS for lead is a 0.15 ug/m^3 average in any 3-month period (also know as a 3-month rolling average). None of the lead concentrations from the DEP sampling approached this level and therefore are not a concern.

Differences Between the DEP and USA TODAY Studies

The USA TODAY report used the Risk-Screening Environmental Indicator (RSEI) model to rank each school relative to one another based on the pollutants likely to be in the air outside the school. The RSEI is a *screening tool* developed by the EPA to put Toxic Release Inventory (TRI) emission data into a health context. The model is used as a priority-setting tool to focus resources in areas that will provide the "greatest potential risk reduction". RSEI results do not provide quantitative risk estimates. TRI emissions data are self-reported by facilities and may contain errors.

By relying on a model that uses just emission data from large sources, studies like the USA TODAY's may miss contributions from other sources, such as mobile sources (pollution from cars, trucks, buses, etc.) Pollutant concentrations measured through sampling are generally considered more reliable than modeled concentrations because they take into account all sources.

Conclusion

Through modeling, the USA TODAY ranked the Iroquois High School as one which may have unacceptable health risks to the student. However sampling by DEP for the stated pollutants of concern (manganese, chromium, nickel and 1,2,4-trimethylbenzene), as well as other pollutants, does not indicate an unacceptable risk to the students attending the school.

For additional information on modeled toxic concentrations in the United States down to the census tract level, see the EPA National Air toxics Assessment (NATA) web site at:
http://www.epa.gov/ttn/atw/natamain/.

Table 2. DEP toxic metal sampling results at the Iroquois Junior-Senior High School.

CAS #	Metal	USA TODAY Sample ug/m^3	DEP Samples[a] 3/31/09 ug/m^3	4/16/09 ug/m^3	4/22/09 ug/m^3	4/29/09 ug/m^3	Average ug/m^3	Unit Risk Factor (URF) m^3/µg	Source URF	Excess Lifetime Cancer Risk[b]	2007 PA Excess Lifetime Cancer Risk[c]	Reference Air Conc. (RfC) µg/m^3	Source RfC	Hazard Quotient[d]
7440-38-2	Arsenic	no	0.00080	0.00131	0.00024	0.00061	0.00074	4.3E-03	IRIS	3.2E-06	3.6E-06	1.5E-02	CalEPA	0.05
7440-41-7	Beryllium	sampling	<RL	<RL	<RL	<RL		2.4E-03	IRIS			2.0E-02	IRIS	
7440-43-9	Cadmium		0.00010	0.00015	0.00012	0.00012	0.00012	1.8E-03	IRIS	2.2E-07	4.6E-07			
7440-47-3	Chromium (Total)		0.00043	0.00089	0.00039	0.00042	0.00053							
18540-29-9	Chromium VI (Assumed)[e]						0.00008	1.2E-02	IRIS	9.1E-07	5.0E-06	1.0E-01	IRIS	0.00
7439-92-1	Lead[f]		0.00429	0.00458	0.00287	0.00294	0.00367	1.2E-05	CalEPA	4.4E-08	8.9E-08			
7439-96-5	Manganese		0.00630	0.01251	0.00746	0.00713	0.00835					5.0E-02	IRIS	0.17
	Nickel[g]		0.00182	0.00219	0.00071	0.00048	0.00130	2.4E-04	IRIS	3.1E-07	6.3E-07			
7440-66-6	Zinc		0.01928	0.00041	0.00449	0.01163	0.00895							
									Total	4.7E-06	9.9E-06		Hazard Index	0.2

[a] Samples were collected over a 96-hour period beginning on the date shown using EPA Method IO-2 and IO-3.

[b] Risk due to inhalation is based on the average of three samples (ELCR = Avg x URF). Risk is not calculated for compounds that were not detected in all four samples.

[c] Calculated by averaging data collected in 2007 at the Chester, Erie, Lancaster, Lewisburg, Marcus Hook, Reading and Swarthmore toxic monitoring sites.

[d] A Hazard Quotient < 1 indicates no expected non-cancer health effects (HQ = Avg / RfC). The HQ is not calculated for compounds that were not detected in all four samples.

[e] Chromium VI concentration assumed to be 1/7th the Total Chromium concentration by DEP for study purposes.

[f] The NAAQS standard for lead is 0.15 ug/m^3 (rolling 3-month average).

[g] The URF for Nickel is the IRIS value for Nickel (Refinery Dust).

<RL - Compound not detected, or less than the Lab Reporting Limit (RL), in all three DEP samples.

\# - Compound not detected. DEP substituted 1/2 the Reporting Limit to calculate average.

IRIS - EPA's Integrated Risk Information System

CalEPA - California EPA

Table 3. DEP VOC sampling results at the Iroquois Junior-Senior High School.

CAS #	Compound	USA TODAY Sample ug/m³	DEP Samples[a] 3/26/09 ug/m³	4/17/09 ug/m³	4/23/09 ug/m³	7/7/09 ug/m³	7/12/09 ug/m³	7/22/09 ug/m³	Average ug/m³	Unit Risk Factor (URF) m³/µg	Source URF	Excess Lifetime Cancer Risk[b]	2007 PA Excess Lifetime Cancer Risk[c]	Reference Air Concentration (RfC) µg/m³	Source RfC	Hazard Quotient[d]
71-55-6	1,1,1-Trichloroethane	no	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						5.0E+03	IRIS	
79-34-5	1,1,2,2-Tetrachloroethane	sampling	<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		5.8E-05	IRIS					
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane		0.843	0.690	0.682	0.590	0.077	0.406	0.548					3.0E+04	HEAST	0.00
79-00-5	1,1,2-Trichloroethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		1.6E-05	IRIS					
75-34-3	1,1-Dichloroethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		1.6E-06	CalEPA			5.0E+02	HEAST	
75-35-4	1,1-Dichloroethene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						2.0E+02	IRIS	
95-63-6	1,2,4-Trimethylbenzene		0.737	0.786	1.180	0.934	0.492	0.354	0.747					7.0E+00	PROV	0.11
106-93-4	1,2-Dibromoethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		6.0E-04	IRIS			9.0E+00	IRIS	
76-14-2	1,2-Dichloro-1,1,2,2,tetrafluoroethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL								
95-50-1	1,2-Dichlorobenzene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						2.0E+02	HEAST	
107-06-2	1,2-Dichloroethane		0.101	0.040	0.040	0.040	0.097	0.040	0.060	2.6E-05	IRIS	1.6E-06	3.2E-06			
78-87-5	1,2-Dichloropropane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		1.0E-05	CalEPA			4.0E+00	IRIS	
108-67-8	1,3,5-Trimethylbenzene		0.049	0.049	0.049	0.049	1.966	0.049	0.369					6.0E+00	PROV	0.06
106-99-0	1,3-Butadiene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		3.0E-05	IRIS			2.0E+00	IRIS	
541-73-1	1,3-Dichlorobenzene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL								
106-46-7	1,4-Dichlorobenzene		0.601	0.553	0.060	0.463	0.421	0.601	0.450	1.1E-05	CalEPA	4.9E-06		8.0E+02	IRIS	0.00
106-94-5	1-Bromopropane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL								
622-96-8	1-Ethyl-4-methylbenzene		0.447	0.467	0.329	0.639	1.671	0.049	0.600							
78-93-3	2-Butanone (MEK)		4.717	0.322	5.602	0.678	11.204	0.322	3.808					5.0E+03	IRIS	0.00
591-78-6	2-Hexanone		0.417	0.417	0.417	3.196	0.417	0.417	0.880							
1634-04-4	2-Methoxy-2-methylpropane (MTBE)		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		2.6E-07	CalEPA		1.9E-08	3.0E+03	IRIS	
108-10-1	4-Methyl-2-pentanone (MIBK)		0.983	0.452	0.452	0.452	0.452	0.452	0.541					3.0E+03	IRIS	0.00
71-43-2	Benzene		2.363	2.363	0.830	1.629	0.894	0.447	1.421	7.8E-06	IRIS	1.1E-05	6.2E-06	3.0E+01	IRIS	0.05
75-27-4	Bromodichloromethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		3.7E-05	CalEPA					
75-25-2	Bromoform		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		1.1E-06	IRIS					
74-83-9	Bromomethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						5.0E+00	IRIS	
75-15-0	Carbon disulfide		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						7.0E+02	IRIS	
56-23-5	Carbon tetrachloride		-	0.629	0.629	0.818	0.818	0.616	0.702	1.5E-05	IRIS	1.1E-05	8.0E-06	4.0E+01	CalEPA	0.02
108-90-7	Chlorobenzene		0.189	0.092	0.092	0.092	0.092	0.092	0.108					5.0E+01	PROV	0.00
75-00-3	Chloroethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						1.0E+04	IRIS	
75-01-4	Chloroethene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		8.8E-06	IRIS		3.4E-07	1.0E+02	IRIS	
67-66-3	Chloroform		0.132	0.229	0.049	0.127	0.049	0.117	0.117	2.3E-05	IRIS	2.7E-06	3.4E-06	3.0E+02	CalEPA	0.00
74-87-3	Chloromethane		1.900	1.239	1.053	1.156	0.041	0.743	1.022	1.8E-06	HEAST	1.8E-06	1.8E-06	9.0E+01	IRIS	0.01
156-59-2	cis-1,2-Dichloroethene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL								
10061-01-5	cis-1,3-Dichloro-1-propene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		4.0E-06	IRIS			2.0E+01	IRIS	
110-82-7	Cyclohexane		0.155	0.086	0.034	0.034	0.148	0.034	0.082					6.0E+03	IRIS	0.00
124-48-1	Dibromochloromethane		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		2.7E-05	CalEPA					
75-71-8	Dichlorodifluoromethane		4.153	3.115	2.966	2.670	0.049	1.928	2.480					2.0E+02	HEAST	0.01
100-41-4	Ethylbenzene		0.434	0.434	0.400	0.738	0.248	0.182	0.406	2.5E-06	CalEPA	1.0E-06	4.7E-07	1.0E+03	IRIS	0.00
87-68-3	Hexachloro-1,3-butadiene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		2.2E-05	IRIS					
108-38-3	m&p-Xylene		1.346	1.390	1.390	2.302	0.317	0.565	1.218					1.0E+02	IRIS	0.01
75-09-2	Methylene chloride		1.666	0.660	0.833	0.486	0.069	0.417	0.689	4.7E-07	IRIS	3.2E-07	1.2E-07	4.0E+02	CalEPA	0.00
142-82-5	n-Heptane		0.820	5.737	0.221	0.615	0.901	0.143	1.406							
110-54-3	n-Hexane		0.881	0.035	0.271	1.163	0.035	0.338	0.454					7.0E+02	IRIS	0.00
95-47-6	o-Xylene		0.521	0.521	0.651	1.042	0.334	0.265	0.556					1.0E+02	IRIS	0.01
115-07-1	Propene		2.238	2.582	1.446	0.585	0.175	0.758	1.297					3.0E+03	CalEPA	0.00
100-42-5	Styrene		0.895	0.354	0.187	0.102	0.043	0.107	0.281					1.0E+03	IRIS	0.00
127-18-4	Tetrachloroethene (PERC)		0.136	0.136	0.481	0.136	0.136	0.156	0.197	5.9E-06	CalEPA	1.2E-06	1.2E-06	6.0E+02	NCEA	0.00
109-99-9	Tetrahydrofuran (THF)		0.796	0.029	0.029	0.029	0.029	0.029	0.157							
108-88-3	Toluene		6.026	5.273	2.448	5.649	2.109	1.544	3.842					5.0E+03	IRIS	0.00
156-60-5	trans-1,2-Dichloroethene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL						6.0E+01	PROV	
10061-02-6	trans-1,3-Dichloro-1-propene		<MDL	<MDL	<MDL	<MDL	<MDL	<MDL		4.0E-06	IRIS			2.0E+01	IRIS	
79-01-6	Trichloroethylene (TCE)		0.172	0.054	0.054	0.054	0.054	0.113	0.083	1.14E-04	NCEA	9.5E-06	2.3E-05	4.0E+01	NCEA	0.00
75-69-4	Trichlorofluoromethane		2.191	1.629	1.629	1.348	0.056	1.011	1.311					7.0E+02	HEAST	0.00
											Total	4.5E-05	4.8E-05		Hazard Index	0.3

[a] Samples were collected over a 24-hour period using EPA Method TO-15.

[b] Risk based on the average of six samples (ELCR = Avg x URF). Risk is not calculated for compounds that were not detected in all six samples.

[c] Calculated by averaging data collected in 2007 at the Arendtsville, Chester, Erie, Lancaster, Lewisburg, Marcus Hook, Reading and Swarthmore toxic monitoring sites.

[d] A Hazard Quotient < 1 indicates no expected non-cancer health effects (HQ = Avg / RfC). The HQ is not calculated for compounds that were not detected in all six samples.

<MDL - Compound not detected, or less than the Method Detection Limit (MDL), in all three DEP samples.

\# - Compound not detected. DEP substituted 1/2 the Method Detection Limit to calculate average.

IRIS - EPA's Integrated Risk Information System

PROV - EPA's Provisional Peer Reviewed Toxicity Values

HEAST - EPA's Health Effects Assessment Summary Tables

CalEPA - California EPA

NCEA - EPA's National Center for Environmental Assessment

Table 4. DEP naphthalene sampling results at the Iroquois Junior-Senior High School.

CAS #	Compound	USA TODAY Sample ug/m^3	DEP Samples[a] 7/7/09 ug/m^3	7/12/09 ug/m^3	7/22/09 ug/m^3	Average ug/m^3	Unit Risk Factor (URF) m^3/µg	Source URF	Excess Lifetime Cancer Risk[b]	Reference Air Conc. (RfC) µg/m^3	Source RfC	Hazard Quotient[c]
91-20-3	Naphthalene	none	1.00	0.39	0.28	0.56	3.4E-05	CalEPA	1.9E-05	3.0E+00	IRIS	0.19

[a] Samples were collected over a 24-hour period beginning on the date shown using EPA Method TO-15 and analyzed by Test America.

[b] Risk due to inhalation is based on the average of samples (ELCR = Avg x URF).

[c] A Hazard Quotient < 1 indicates no expected non-cancer health effects (HQ = Avg / RfC).

CalEPA - California EPA

IRIS - EPA's Integrated Risk Information System