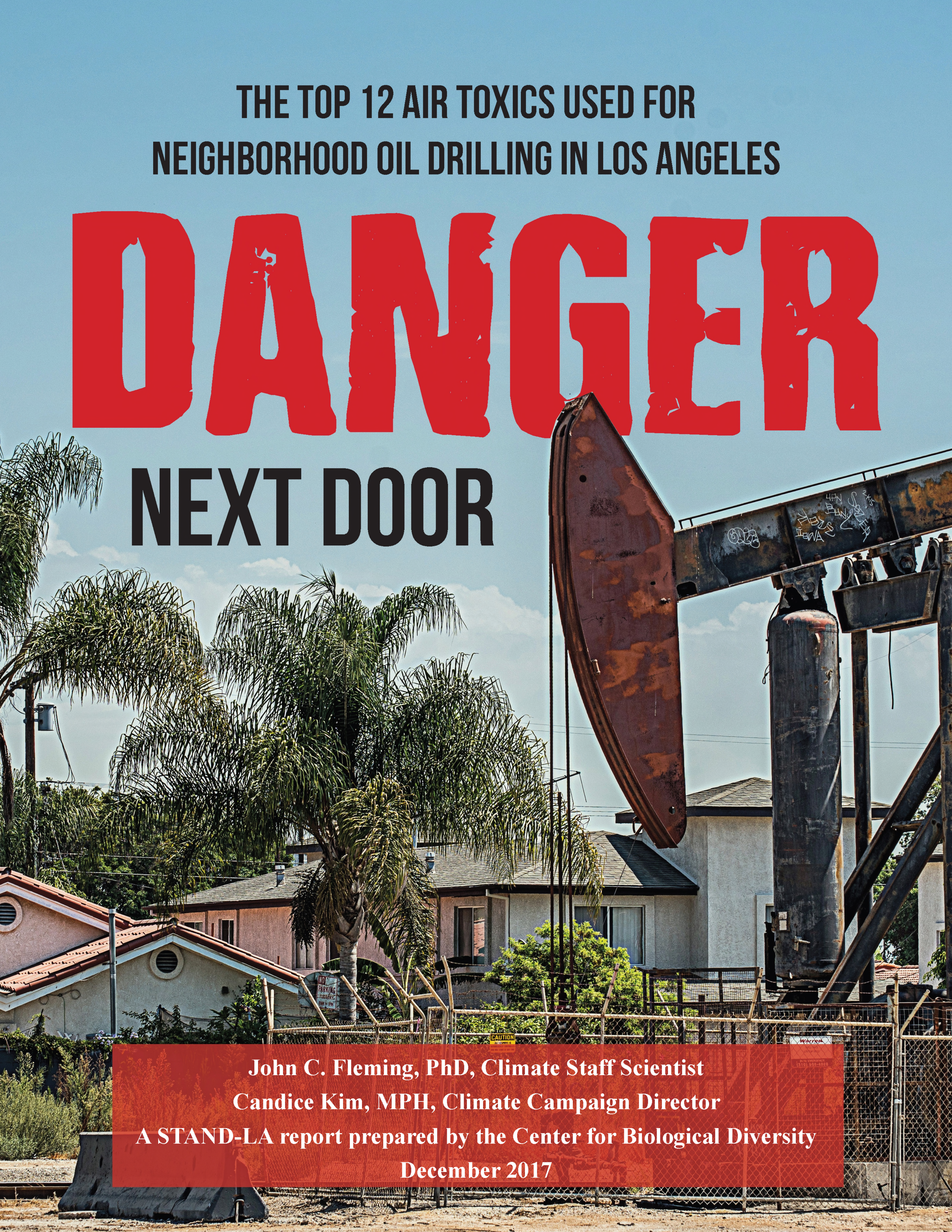
THE TOP 12 AIR TOXICS USED FOR NEIGHBORHOOD OIL DRILLING IN LOS ANGELES

DANGER NEXT DOOR



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Cover photo: Signal Hill, Greater Los Angeles area, by Harrison Weinberg; Photo above: Jefferson drill site, Los Angeles, by Redeemer Community Partnership

EXECUTIVE SUMMARY

Every day in Los Angeles, neighborhood oil drilling releases dozens of toxic chemicals into the air near homes, schools, and hospitals. According to South Coast Air Quality Management District records analyzed by Center for Biological Diversity scientists, oil companies used more than 98 million pounds — or 49,000 tons — of chemicals known to cause serious health effects in humans ("air toxics") in Los Angeles County between June 2013 and February 2017. More than 21 million pounds — or 10,500 tons — were used in the city of Los Angeles alone,

The known air toxics most frequently used by oil companies in the Los Angeles air basin include crystalline silica, methanol, hydrofluoric acid, and formaldehyde. These chemicals pose serious health concerns. Formaldehyde, for example, harms the eyes and respiratory system and is classified as a cancer-causing substance by the International Agency for Research on Cancer and the California Air Resources Board.

For both the city and county of Los Angeles, over 80 percent of air toxics uses — both in terms of number of uses and mass of chemicals used — came from just 12 air toxic chemicals. These chemicals were used in at least 227 different oil-related operations in the city of Los Angeles, and in at least 1,140 different oil-related operations county-wide.

In total, air toxics were used over 11,000 times in Los Angeles County. Oil companies claimed "trade secret" protection 1,900 times for chemicals used in the city of Los Angeles and nearly 12,000 times for chemicals used county-wide. This means that even more air toxics and other hazardous chemicals could have been used than were disclosed.

The tens of thousands of tons of toxic air chemicals used in Los Angeles County and surrounding communities pose unacceptable public health and safety risks. Through inadequate reporting and secrecy, oil companies hide the full health risks from the public. State and local governments must take stronger action to protect our communities from these dangerous oil industry chemicals.

"OIL COMPANIES USED MORE THAN 98 MILLION POUNDS OF CHEMICALS KNOWN TO CAUSE SERIOUS HEALTH EFFECTS IN HUMANS IN LOS ANGELES COUNTY BETWEEN JUNE 2013 AND FEBRUARY 2017."

BACKGROUND AND METHODS

In April 2013, the South Coast Air Quality Management District ("Air District") adopted Rule 1148.2, establishing California's first notification and reporting requirements for selected oil and gas recovery activities. Starting June 4, 2013, the Air District required oil and gas well operators to submit reports ("Event Reports") that disclose where and when they plan to conduct well drilling, completion, and reworking operations. Well completion operations, which prepare a well for oil and gas production, and well reworking operations, which maintain existing wells, can include the use of well stimulation techniques such as acidizing, gravel packing, and fracking that are known to use toxic chemicals.

The rule also requires operators to disclose the chemicals used in these operations in a publicly available chemical report within 60 days of completing the activity ("Chemical Reports"). In July 2013, operators started disclosing some, but not all, of the chemicals being used. As required by the rule, the Air District has made this data available online.

For the city and county of Los Angeles, Center scientists analyzed available Air District data between June 4, 2013 and February 28, 2017 to examine the number and location of well stimulation activities, the types and amounts of chemicals used in these operations, and the public health and safety risks posed by air toxic chemicals.

We used the definition of an air toxic chemical established in Rule 1148.2.[1] An air toxic is a hazardous chemical that can become either a vapor or particles small enough to be transported through the air. The frequency of their use during well drilling, well completion and well maintenance poses a significant health risk.

FINDINGS

(1) Well stimulation events are common and often occur next to homes, schools, and hospitals in Los Angeles County.

Between June 2013 and February 2017, there were 1,140 instances of acidizing, gravel packing, and fracking in Los Angeles County, with 227 instances in the city of Los Angeles itself.

Air District data show that 483 air toxic-utilizing well activities occurred within 1,500 feet of residences, schools, hospitals, and health care facilities in Los Angeles County. At least three schools, three hospitals or health care facilities, and 93 homes in Los Angeles County were within 1,500 feet of these repeated well stimulation operations.

Acidizing: Acidizing is a process in which a combination of hydrochloric acid and other acids are mixed with brine and other chemicals and injected underground to either clean out a well or to dissolve oil-bearing rock to enhance production of oil and gas. Once the acid, chemical, and water mixture has been pumped into the well or formation, oil flows to the well more freely.

"BETWEEN JUNE 2013 AND FEBRUARY 2017, THERE WERE 1,140 INSTANCES OF ACIDIZING, GRAVEL PACKING, AND FRACKING IN LOS ANGELES COUNTY, WITH 227 INSTANCES IN THE CITY OF LOS ANGELES ITSELF."

Since event reporting began in early June 2013 until February 2017, there were approximately 859 acidizing events reported in Los Angeles County and 188 in the city of Los Angeles. Prior to June 2014, the type of acidizing event was not reported. After June 2014, acidizing events were either reported as maintenance acidizing, matrix acidizing, acid fracturing, acidizing perforations, or non-stim acid wash. Total acidizing events stated in this report represent the sum of all of these techniques.

Gravel Packing: In gravel packing, gravel is injected with a chemical mixture and placed near the wellbore to form filters that help prevent the buildup of sand inside the well. Minimizing sand buildup increases the flow of oil to the surface. Between June 2013 and February 2017, there were approximately 275 gravel packing events reported in Los Angeles County and 39 in the city of Los Angeles.

Hydraulic Fracturing: Also known as "fracking," hydraulic fracturing is a recovery method in which large amounts of water, sand (typically), and chemicals are injected under extremely high pressures into a rock formation to create fractures in the oil-bearing rock to enhance oil flow from the well. Between June 2013 and February 2017, there were approximately 6 fracking events reported in Los Angeles County.

Los Angeles County

There were over 1,000 well stimulation events in Los Angeles County (Tables 1 and 2):

Table 1: Well stimulation activities in Los Angeles County between June 4, 2013 and February 28, 2017

Well Stimulation	Reported Occurrences
Acidizing	859
Gravel Packing	275
Hydraulic Fracturing	6
Total	**1,140**

Table 2: Well stimulation activities in Los Angeles County by year

Well Stimulation	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Acidizing#	266	265	165	163
Gravel Packing	93	152	19	11
Hydraulic Fracturing	6	0	0	0
Total	**365**	**417**	**184**	**174**

*Data from this time period does not cover a full year.

Includes reports of acidizing, maintenance acidizing, matrix acidizing, acid fracturing, acidizing perforations, and not stim-acid wash.

These events were also divided based on whether well drilling, well completion, or well rework was conducted (Tables 3 and 4):

Table 3: Well activities and stimulation techniques in Los Angeles County between June 4, 2013 and February 28, 2017

Well Stimulation	Well Drilling*	Well Completion	Well Rework
Acidizing	0	28	830
Gravel Packing	0	181	94
Hydraulic Fracturing	0	6	0
Other	299	12	23
Total	**299**	**227**	**947#**

*Well drilling is not associated with any well stimulation activities by definition.

#Total "well rework" includes two events where both acidizing and gravel packing occurred, so those events are part of both the "acidizing" and the "gravel packing" totals.

Table 4: Well activities in Los Angeles County by year

Well Activity	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17
Well Drilling	127	146	18	8
Well Completion	96	101	19	11
Well Rework	298	319	165	163
Total	**521**	**566**	**202**	**182**

City of Los Angeles

There were at least 227 well stimulation events in the city of Los Angeles (Tables 5 and 6):

Table 5: Well stimulation activities in the city of Los Angeles between June 4, 2013 and February 28, 2017

Well Stimulation	Reported Occurrences
Acidizing	188
Gravel Packing	39
Hydraulic Fracturing	0
Total	**227**

Table 6: Well stimulation activities in the city of Los Angeles by year

Well Stimulation	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Acidizing[#]	78	56	35	19
Gravel Packing	21	18	0	0
Hydraulic Fracturing	0	0	0	0
Total	**99**	**74**	**35**	**19**

*Data from this time period does not cover full year.

[#] Includes reports of acidizing, maintenance acidizing, matrix acidizing, acid fracturing, acidizing perforations, and not stim-acid wash.

These events were also divided based on whether well drilling, well completion, or well rework was conducted (Tables 7 and 8):

Table 7: Well activities and stimulation techniques in the city of Los Angeles between June 4, 2013 and February 28, 2017

Well Stimulation	Well Drilling*	Well Completion	Well Rework
Acidizing	0	9	179
Gravel Packing	0	19	19
Hydraulic Fracturing	0	0	0
Other	54	2	15
Total	**54**	**30**	**213**

*Well drilling is not associated with any well stimulation activities by definition.

Table 8: Well activities the city of Los Angeles by year

Well Activity	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17
Well Drilling	35	16	3	0
Well Completion	18	12	0	0
Well Rework	96	63	35	19
Total	**149**	**91**	**38**	**19**

Inglewood Oil Field © Gary Kavanagh 2017

Proximity to Homes, Schools, and Hospitals

Well activities using air toxic chemicals occurred close to sensitive receptors multiple times. The table below shows the number of times any reportable event occurred within 1,500 feet of a sensitive receptor ("number of event exposures"). "Number of unique receptors" is based on the addresses of sensitive receptors provided by the well operators. These unique receptors were exposed to certain well activities multiple times.

It is important to note that operators are only required to report the *closest* receptor within 1,500 feet during a given event, so the number of unique receptors stated in the tables below likely does not represent the total number of receptors found within 1,500 feet of an event. This is especially so since many of the unique receptors reported are located in densely populated areas.

Table 9: Proximity of air toxic usage to sensitive receptors in Los Angeles County between June 4, 2013 and February 28, 2017

Sensitive Receptors	# of Unique Receptors (99)	# of Event Exposures (483)	Distance Range (ft)	Median Distance (ft)	Mean Distance (ft)
Residence	93	444	12-1500	506	591
School	2	8	1285-1457	1428	1409
Preschool	1	7	342-362	362	353
Hospital	1	15	160-200	200	197
Healthcare Facility	2	9	96-200	132	149

Table 10: Proximity of air toxic usage to sensitive receptors in the city of Los Angeles between June 4, 2013 and February 28, 2017

Sensitive Receptors	# of Unique Receptors (39)	# of Event Exposures (178)	Distance Range (ft)	Median Distance (ft)	Mean Distance (ft)
Residence	35	147	12-1492	489	607
School	--	--	--	--	--
Preschool	1	7	342-362	362	353
Hospital	1	15	160-200	200	197
Healthcare Facility	2	9	96-200	132	149

"BETWEEN JUNE 2013 AND FEBRUARY 2017, AT LEAST 38 DIFFERENT AIR TOXIC CHEMICALS WERE USED IN LOS ANGELES COUNTY..."

(2) More than 98 million pounds of at least 38 different kinds of air toxic chemicals were used in Los Angeles County between June 2013 and February 2017.

Between June 2013 and February 2017, at least 38 different air toxic chemicals were used in Los Angeles County with 35 of these also used in the city of Los Angeles, amounting to more than 98 million pounds county-wide. The top 12 air toxic chemicals were the same in the city and county of Los Angeles except that cumene appears only on the county list while isopropanol appears only on the city list. The most commonly used air toxic was crystalline silica.

Los Angeles County

At least 38 different air toxics were used more than 11,000 times in Los Angeles County. The 12 most frequently used air toxic chemicals accounted for over 80 percent of all air toxic usage (Tables 11, 12, and 13).

Table 11: The 12 most commonly used air toxics in Los Angeles County between June 4, 2013 and February 28, 2017

Rank	Chemical	CASRN**	Number of Instances Used	Total amount by mass (lbs.)
1	Crystalline Silica*	14808-60-7	3,222	46,886,251
2	Methanol	67-56-1	1,622	219,145
3	Hydrochloric Acid^	7647-01-0	1,217	20,994,937
4	Formaldehyde	50-00-0	695	79,075
5	Hydrofluoric Acid^	7664-39-3	593	10,206,305
6	Naphthalene	91-20-3	554	102,159
7	2-Butoxy Ethanol*	111-76-2	522	198,175
8	Xylene	1330-20-7	385	250,238
9	Ethylbenzene	100-41-4	370	120,512
10	Cumene	98-82-8	335	21,828
11	Aluminum Oxide*	1344-28-1	277	1,619,464
12	Glutaral/Pentanedial	111-30-8	259	290,752
13	*Remaining Air Toxics#*	--	*1,572*	*17,754,394*
Total			**11,623**	**98,743,235**

*Crystalline silica was also reported in the Air District dataset as cristobalite (CASRN 1446-44-61) and tridymite (CASRN 15468-32-3). Additionally, it was reported as quartz, but with the same CASRN as reporting for crystalline silica (14808-60-7). 2-butoxy ethanol was also reported as ethylene glycol monobutyl ether and glycol ether EB but with the same CASRN. Aluminum oxide was also reported as alumina but with the same CASRN.

^When reported, concentrations of hydrochloric and hydrofluoric acids ranged from 7.6-30% and 1-3%, respectively. In many instances, the concentration was not disclosed.

#Remaining air toxics includes a significant contribution from barium sulfate compounds, either barite or sulfuric acid, barium salt (1:1). These are not explicitly stated as reportable air toxics under Rule 1148.2, but barium compounds in general are listed as reportable under the rule. Barium compounds were collectively used 348 times for a total of over 16 million pounds in Los Angeles County. Barium compounds are included in the counts of air toxics, but not as part of the top 12. The same is the case for usage numbers presented for the city of Los Angeles.

**The CASRN is the Chemical Abstracts Service Registry Number that is the unique numeric identifier for that chemical substance.

Table 12: The usage of the 12 most commonly used air toxics in Los Angeles County by year

Chemical	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Crystalline Silica	1,484	1,604	103	31
Methanol	809	549	178	86
Hydrochloric Acid	493	488	159	77
Formaldehyde	229	311	105	50
Hydrofluoric Acid	213	213	109	58
Naphthalene	188	273	79	14
2-Butoxy Ethanol	213	148	108	53
Xylene	120	182	62	21
Ethylbenzene	115	177	60	18
Cumene	100	172	53	10
Aluminum Oxide	148	111	13	5
Glutaral/Pentanedial	125	117	14	3
Total	**4,237**	**4,345**	**1,043**	**426**

Table 13: Masses (lbs.) used of the 12 most commonly used air toxics in Los Angeles County by year

Chemical	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Crystalline Silica	20,946,823	25,047,467	759,850	132,110
Methanol	143,442	48,624	19,931	7,146
Hydrochloric Acid	11,086,015	8,322,220	1,219,533	367,167
Formaldehyde	36,296	40,229	2,546	1.95
Hydrofluoric Acid	5,650,666	4,114,403	412,147	29,088
Naphthalene	67,045	33,402	1,705	6.39
2-Butoxy Ethanol	106,224	47,695	31,564	12,690
Xylene	120,690	41,431	53,277	34,839
Ethylbenzene	75,324	19,856	20,682	4,648
Cumene	8,854	12,297	658	19.1
Aluminum Oxide	830,107	745,837	35,882	7,636
Glutaral/Pentanedial	94,595	189,679	6,300	176.8
Total	**39,166,081**	**38,663,140**	**2,564,075**	**595,528**

City of Los Angeles

At least 35 different air toxics were used more than 2,500 times in the city of Los Angeles. The 12 most frequently used air toxic chemicals accounted for nearly 90 percent of all air toxic usage (Tables 14, 15, and 16).

Table 14: The usage of the 12 most commonly used air toxics in the city of Los Angeles between June 4, 2013 and February 28, 2017

Rank	Chemical	CASRN	Number of Instances Used	Total amount by mass (lbs.)
1	Crystalline Silica	14808-60-7	617	6,177,903
2	Methanol	67-56-1	588	86,304
3	Hydrochloric Acid	7647-01-0	304	8,457,348
4	2-Butoxy Ethanol	111-76-2	271	161,367
5	Hydrofluoric Acid	7664-39-3	119	3,635,261
6	Formaldehyde	50-00-0	104	13,811
7	Aluminum Oxide	1344-28-1	63	314,353
8	Glutaral/Pentanedial	111-30-8	62	31,859
9	Xylene	1330-20-7	54	217,802
10	Isopropanol	67-63-0	53	6,304
11	Ethylbenzene	100-41-4	42	93,472
12	Naphthalene	91-20-3	39	44,365
13	*Remaining Air Toxics*	--	*321*	*1,801,518*
Total			**2,637**	**21,041,667**

Table 15: The usage of the 12 most commonly used air toxics in the city of Los Angeles by year

Chemical	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Crystalline Silica	460	157	0	0
Methanol	352	184	38	14
Hydrochloric Acid	154	100	36	14
2-Butoxy Ethanol	145	75	32	19
Hydrofluoric Acid	51	42	20	6
Formaldehyde	50	36	14	4
Aluminum Oxide	50	13	0	0
Glutaral/Pentanedial	47	14	1	0
Xylene	15	22	11	6
Isopropanol	37	4	7	5
Ethylbenzene	13	17	8	4
Naphthalene	19	18	2	0
Total	**1,393**	**682**	**169**	**72**

Table 16: Masses (lbs.) used of the 12 most commonly used air toxics in the city of Los Angeles by year

Chemical	6/4/13 – 6/3/14	6/4/14 – 6/3/15	6/4/15 – 6/3/16	6/4/16 – 2/28/17*
Crystalline Silica	4,139,216	2,038,686	0	0
Methanol	55,405	22,110	6,998	1,790
Hydrochloric Acid	4,780,693	2,931,899	561,119	183,636
2-Butoxy Ethanol	84,811	41,163	24,220	11,172
Hydrofluoric Acid	1,985,725	1,447,276	196,785	5,472
Formaldehyde	8,442	4,641	727	0.27
Aluminum Oxide	196,471	117,882	0	0
Glutaral/Pentanedial	14,515	14,439	2,904	0
Xylene	104,725	29,903	52,712	30,461
Isopropanol	2,648	16	130	3,508
Ethylbenzene	61,951	8,329	19,732	3,459
Naphthalene	42,479	1,822	64	0
Total	**11,445,096**	**6,658,166**	**865,391**	**239,498**

(3) "Trade Secret" claims conceal key information from the public.

The Chemical Reports reviewed for this analysis may significantly understate the frequency and volume of chemical use. Between June 2013 and February 2017, operators withheld chemical information from their reports 11,496 times in Los Angeles County and 1,900 times in the city of Los Angeles. In these instances, operators chose to report only the "chemical family name" for the undisclosed chemical.

The full extent of the risks of oil recovery techniques is still unknown, in part because oil companies have kept the identity of certain chemicals hidden from the public based on claims that the list of chemicals used in certain "products" is a trade secret.

Instead of disclosing the chemicals used, the company merely submits a vague description, which the Air District substitutes for the real chemical information when the reports are posted online. These descriptions are often so vague that they do not provide the public with useful information about what chemicals were used. For example, some "trade secret" chemicals are described as a "lubricant," "surfactant," or simply, "mixture."

In addition, many of the trade-secret protected chemicals are marked as air toxics. Of the 11,496 trade-secret chemicals reported in Los Angeles County, 2,811 were marked as air toxics, without any further information. For the city of Los Angeles, 190 of the 1,900 trade-secret chemicals reported were marked as air toxics.

Considering the consistent mislabeling of many air toxics in the Air District dataset as non-air toxic, many more of these undisclosed chemicals could be air toxics.

A lack of chemical disclosure is just one example of a flawed regulatory framework where government agencies have neglected to adequately protect public health. California's Division of Oil, Gas, and Geothermal Resources continues to permit oil and gas extraction activities in communities where severe health impacts can occur. The South Coast Air Quality Management district still has an inadequate accounting of the air toxics emanating from these oil and gas activities, and therefore inadequate processes to regulate their release.

The known amounts of air toxics used as indicated in this report are more than enough to cause alarm. The fact that there are even more chemicals which have not been disclosed is all the more troubling.

(4) Oil industry use of air toxics in LA communities poses unacceptable public health and safety risks.

In 2013, Jared Blumenfeld, U.S. Environmental Protection Agency regional administrator for the Pacific Southwest, toured a neighborhood drill site in South Los Angeles and was sickened by the fumes. On that day he had a brief glimpse into the everyday experience of residents living near drill sites — fumes strong enough to induce nausea, coughing, and headaches.[2]

Unfortunately, these symptoms are typical for people exposed to irritating air toxics from oil and gas field operations. When exposed, the recommended course of action is typically to leave the contaminated area and seek fresh air. But for residents living near neighborhood drill sites who may feel sickened by fumes on a daily or regular basis, leaving their homes every time they feel sick is not a sustainable option. In addition, there are serious concerns about the cumulative impacts of chemical exposure on residents.

We identified unacceptable public health and safety risks from the use of dozens of air toxics in Los Angeles County communities, including their usage next to homes, schools, and hospitals; the known health risks of these chemicals; and inadequate reporting and secrecy that hide the full risks from the public.

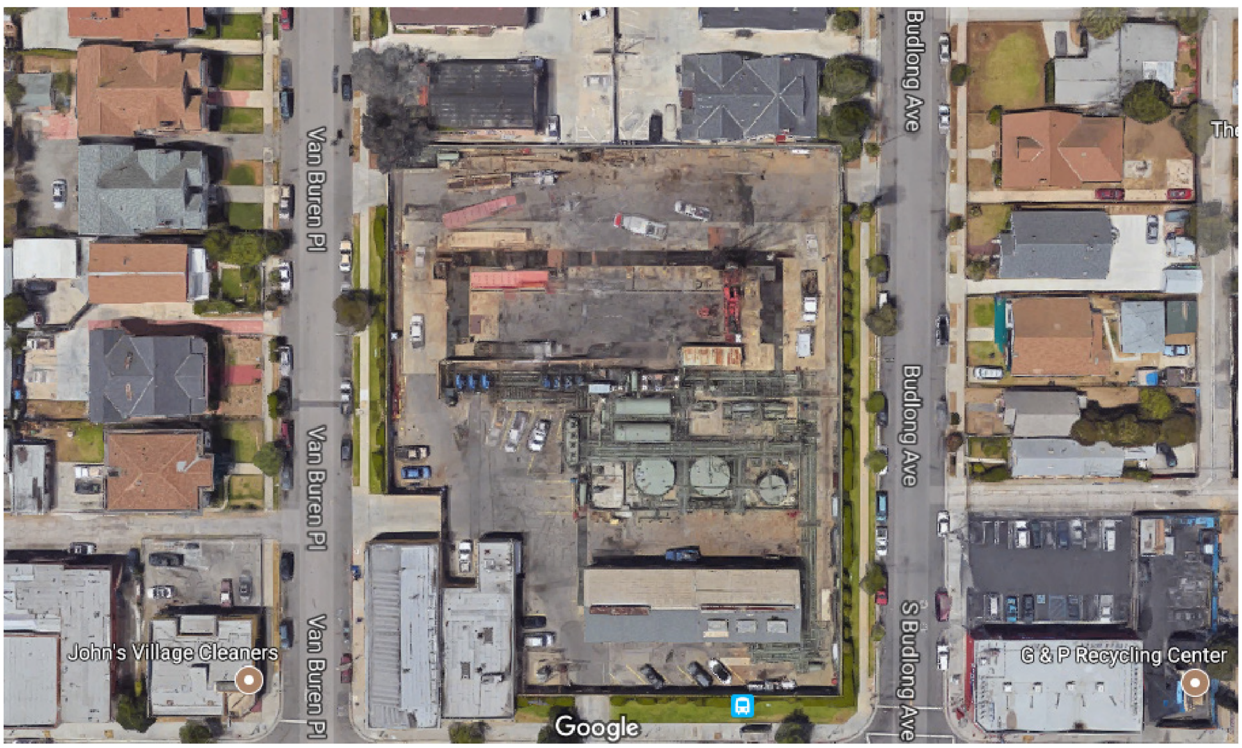
Jefferson drill site, Los Angeles, by Redeemer Community Partnership

(5) Hazardous chemicals are used and stored in close proximity to residences.

A key concern about oil and gas drill sites in Los Angeles is that they operate in densely populated areas. These industrial operations emit large volumes of harmful pollutants close to residences and sensitive receptors. Public health literature suggests that proximity is a primary air toxic exposure risk factor associated with oil and gas operations.[3]

Air District data show that 483 reported well activities using air toxics occurred at sites within 1,500 feet of at least one hospital, preschool, or residence in Los Angeles County. Of these 483 events, 178 occurred in the city of Los Angeles. One event, for example, was within 12 feet of a home in the neighborhood of Wilmington. Another was within 200 feet of a hospital in the city of Los Angeles. And another was within 1,400 feet of a school in Long Beach.

Use of industrial chemicals near communities is of great concern, especially near particularly vulnerable groups such as children and the elderly. Medical and health professionals warn that communities face substantial health risks from proximity to air toxics sources.



(Google Satellite View of Jefferson Drill Site illustrates close proximity to homes.)

Another key concern is related to chemical safety. Many of the top 12 air toxics are recognized as flammable, and some are even potentially explosive.[4] Urban oil extraction brings the risks of industrial drilling to neighborhoods — where the only thing separating neighbors from harmful emissions and industrial activity may be a cinder block wall or chain link fence.

It is unclear whether there is adequate disaster management and communication infrastructure in place at neighborhood drill sites. This creates potential public safety issues for communities that may need to shelter in place or rapidly evacuate in the event of an industrial accident.

(6) The top 12 air toxics pose serious health risks.

The top 12 air toxics used in Los Angeles oil drilling all have known health risks — ranging from short-term sensory irritation to long-term threats such as cancer. Research has documented specific examples of adverse health threats resulting from proximity to oil and gas operations.

Numerous studies, for instance, have found a greater potential for high-risk pregnancies, premature births, low-birthweight babies, and birth defects among pregnant women exposed to pollution from oil and gas activities.

A study of 9,384 women in Pennsylvania found an association between proximity to active drilling and fracking sites and a 40 percent increased risk for having premature labor and 30 percent increased likelihood of high-risk pregnancy.[5]

Another study found that pregnant women who had greater exposure to gas wells, both in terms of proximity and density of wells, had a much higher risk of having low-birthweight babies. This was attributed to air pollution coming from well sites.

A third study in Pennsylvania found that people who live near a higher number of, or larger, active gas wells were 1.5 to 4 times more likely to suffer from asthma attacks than those living farther away, with the closest groups having the highest risk.[6]

Other studies have found that residents living close to oil and gas operations tend to have higher hospitalization rates[7] and more reported health symptoms such as respiratory problems and rashes.[8]

Many of the oil and gas extraction-related chemicals that led to the health impacts documented above are also used in Los Angeles, and therefore pose similar risks. Half of the top 12 air toxics we identified are on California's Proposition 65 list of chemicals known to cause cancer, birth defects or other reproductive harm.[9] These chemicals are also found on the Environmental Protection Agency's list of Hazardous Air Pollutants known to cause cancer and other serious health impacts. There are also nine toxics found on the California Air Resources Board's list of Toxic Air Contaminants that may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health (*See* Table 18).

Hydrochloric acid is one of the most heavily used toxics on our list. It is highly corrosive, and hydrogen chloride gas has an irritating, pungent odor. If inhaled, short-term impacts include irritation of the mucous membranes of the nose, throat, and respiratory tract. Exposures to high concentrations of hydrochloric acid may lead to impacts as severe as suffocation or irreversible lung damage. Massive exposures may lead to Reactive Airway Disease Syndrome (RADS) — the sudden onset of asthma-like symptoms with impacts to airways that can persist for months or years.

So hydrochloric acid alone poses significant health risks. Those risks combined with those of the other 37 air toxics that have been used in Los Angeles County make the situation of those living near oil and gas operations all the more dire.

Inglewood Oil Field © Gary Kavanagh 2017

Table 17: Known health safety risks associated with exposure to the top 12 air toxics

	Eye Irritation	Respiratory Impacts	Nausea and Vomiting	Central Nervous System or Neurological Impacts	Reproductive Harm	Increased Cancer Risk	Chemical is flammable or explosive	Other
2-Butoxy Ethanol [10, 11]	✓	✓					✓	Chronic occupational exposure associated with hematuria
Aluminum Oxide [12, 13]	✓	✓	✓	✓				
Crystalline Silica [4, 14, 15]	✓	✓				✓		Occupational exposures are associated with the development of silicosis, lung cancer, pulmonary tuberculosis, and other serious impacts to lung function.
Cumene [4, 9, 16, 17]	✓	✓		✓		✓	✓	Exposure may cause dizziness, headache, or unconsciousness. Evidence of carcinogenic activity in rats.
Ethylbenzene [4, 18, 19]	✓	✓		✓		✓	✓	Animal studies have reported hearing effects and kidney damage with exposure to low levels.
Formaldehyde [20, 21]	✓	✓		✓		✓		Even very low-dose inhalation exposure can result in headaches and difficulty breathing; high dose exposure may cause severe mucous membrane irritation, burning, and lower respiratory effects such as bronchitis. Sensitive individuals may experience asthma even at very low concentrations.
Glutaral/Pentanedial [22]	✓	✓	✓					Repeated exposure may cause asthma.
Hydrochloric Acid [4, 23, 24]	✓	✓	✓				✓	Highly corrosive — acute inhalation may cause pneumonitis, lung edema, or even death in extreme cases. Repeated exposure may cause reactive airways dysfunction syndrome (RADS).
Hydrofluoric Acid [4, 25, 26]	✓	✓		✓			✓	High levels of exposure may cause lung edema and damage heart.
Isopropanol [4, 27]	✓	✓		✓			✓	
Methanol [4, 28, 29]	✓	✓	✓	✓	✓		✓	Acute exposure may result in persistent or recurring headaches, impaired vision, or even permanent motor dysfunction.
Naphthalene [4, 30, 31, 32]	✓		✓	✓		✓	✓	Exposure to high concentrations may cause hemolytic anemia. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation.
Xylene [4, 33, 34]	✓	✓		✓	✓		✓	Cardiovascular and kidney effects have also been reported.

Table 18: Many of the 12 most frequently used air toxics have well-documented health and environmental risks such as cancer or reproductive effects

	CA Proposition 65 Chemical[9]	EPA Hazardous Air Pollutant[35]	CA Air Resources Board Toxic Air Contaminant[36]
2-Butoxy Ethanol			✓
Aluminum Oxide			
Crystalline Silica	Carcinogen		
Cumene*	Carcinogen	✓	✓
Ethylbenzene	Carcinogen	✓	✓
Formaldehyde	Carcinogen	✓	✓
Glutaral/Pentanedial			
Hydrochloric Acid		✓	✓
Hydrofluoric Acid		✓	✓
Isopropanol#			
Methanol	Reproductive Harm	✓	✓
Naphthalene	Carcinogen	✓	✓
Xylene		✓	✓

*Appears on LA County top 12 air toxics list only
Appears on LA City top 12 air toxics list only

(7) Inadequate reporting and secrecy make it hard to fully assess risks and potential synergistic effects of air toxics.

Under certain conditions, chemicals in a mixture can interact with each other, increasing its level of toxicity. Chemicals with common modes of action can also act jointly to produce combined effects that may be greater than the effects of each constituent alone. However, the potential for synergistic or additive interactions is hard to assess when data gaps, lack of transparency, or trade secrecy claims conceal the identities of many chemicals used at drill sites.

This report uses data collected through the Air District's Rule 1148.2 reporting requirements. Unfortunately, this data does not provide a complete accounting of all the chemicals used in urban oil extraction. The District's reporting requirements only apply to drilling, well completion, or rework of onshore oil or gas wells. Injection well sites, used for some forms of enhanced oil recovery or underground disposal of waste fluid, are excluded from 1148.2 reporting requirements.

This means that the District collects data about some, but not all, potential sources of air toxics related to the oil and gas extraction in the region. This monitoring and data collection gap makes it difficult to fully assess potential air quality or public health impacts from neighborhood drilling.

Other non-reported chemicals used at drill sites include industrial odorants, such as Chemco Odor Control Jasmine, used to mask the smell of hydrogen sulfide that escapes from oil wells.[35] Chemical components of this odorant include nonylphenol ethoxylate, which has been associated with reproductive and developmental effects in rodents.[36]

When residents near the Jefferson drill site spotted a misting apparatus spraying an unidentified liquid in the yard, they grew concerned and contacted the drill operator to ask what it was. Residents reported difficulty accessing information about the chemical from the operator and felt concerned about potential health impacts. They were told that the operator did not have information to share. Residents eventually identified the chemical, Chemco Odor Control Jasmine, without the operator's aid.[37]

Secrecy and lack of transparency about chemicals used in neighborhood oil drilling prevent residents from fully understanding the risks to which they may be exposed. Oil and gas workers can be spotted working in personal protective equipment at neighborhood drill sites—leaving residents feeling unsafe and unprotected.

(8) Health-based decision making should be precautionary.

It would be irresponsible for state and local government regulators to allow neighborhood oil and gas activities to continue given the known health risks of air toxics. Regulators must stop these activities and conduct a health and safety risk assessment of the oil industry chemicals released into our air. Only then can overburdened communities receive the help they need to tackle the health consequences of neighborhood drilling.

The hazards are clear, and for those living in communities plagued by toxic air, the risks are definite. Based on what is already known about air toxics, local and state officials have a social responsibility to protect the public from further exposure.

CONCLUSION

The data reported to the Air District, while incomplete in many ways, shows extensive and widespread use of harmful chemicals by oil companies in the Los Angeles air basin. The pervasive and persistent use of these chemicals threatens to contaminate local air quality and put public health and safety at risk. State and local governments must take stronger action to protect our communities from these dangerous oil industry chemicals.

Inglewood Oil Field © Gary Kavanagh 2017

[1] Rule 1148.2 defines an air toxic as "any substance identified on a list that is compiled and maintained by the California Air Resources Board pursuant to Health and Safety Code Section 44321."

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METHODS APPENDIX

Data tables created in the preparation of this report can be accessed at:

https://www.biologicaldiversity.org/programs/climate_law_institute/downloads/LACityEvent20130604_20170228.xlsx

https://www.biologicaldiversity.org/programs/climate_law_institute/downloads/LACityChem20130604_20170228.xlsx

https://www.biologicaldiversity.org/programs/climate_law_institute/downloads/LACntyEvent20130604_20170228.xlsx

https://www.biologicaldiversity.org/programs/climate_law_institute/downloads/LACntyChem20130604_20170228.xlsx

Data Collection and Organization

"Event Notifications" and "Chemical Reports" required by the South Coast Air Quality Management District ("Air District") under Rule 1148.2 were retrieved from the Air District website at:

http://www.aqmd.gov/home/regulations/compliance/1148-2
through the "Community Members" portal. The language of Rule 1148.2 can be found at:

http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1148-2.pdf?sfvrsn=6.
The South Coast Air Basin covers all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino counties. Event notifications report the types of well stimulation activities that occurred, either acidizing, hydraulic fracturing, or gravel packing, which operators conducted these activities, and where they occurred. These reports also include information on instances of well drilling, well rework, well completion, and the closest sensitive receptor within 1,500 feet of a reported well activity. Chemical reports list the amounts of chemicals used during well events. Records from June 4, 2013 to February 28, 2017 were retrieved and saved as Excel files in three-month data blocks.

From the saved records, data specific to the city of Los Angeles and to Los Angeles County was extracted as the focus of this report. City and County data, respectively, were compiled into separate spreadsheets with separate Excel files for city event notifications, city chemical reports, county event notifications, and county chemical reports. Within these files, data was also split roughly into one-year intervals: June 4, 2013 to June 3, 2014; June 4, 2014 to June 3, 2015; June 4, 2015 to June 3, 2016; June 4, 2016 to February 28, 2017.

Reporting notifications changed after September 2015, so files downloaded with data from before September 2015 were formatted differently from those with data from after September 2015. In compiling records, steps were taken to reconcile the two formatting types.

Event report data included reports of events that were later cancelled or revised. Reports were labeled *original, cancellation, revision date,* or *revision other*. In this way, an original report was sometimes referenced for cancellation or for a revision. In the case of a cancellation report, the report record for both the cancellation and the original report that was cancelled were removed. In the case of revisions, the most recent revision record was kept and all previous reports referenced by that revision were removed. This prevented a single event from being counted more than once.

Data Analysis

Event Reports

Event reports are organized chronologically by event number. Well stimulation events reported are acidizing, gravel packing, and hydraulic fracturing, along with reports of well completion and well rework during which well stimulation techniques are used. In addition, instances of well drilling are reported along with whether or not drilling was horizontal or vertical. Acidizing is further separated into maintenance acidizing, matrix acidizing, and acid fracturing. Prior to June 2014, the specific form of acidizing was not reported, only the fact that some form of acidizing occurred.

In the original Air District data, if a particular well activity occurred, a "Y" for yes was placed underneath that activity next to its event number. A "N" for no was used if that activity did not occur. The COUNT function in Excel was used to determine the number of times a particular well activity occurred. In some cases, activities were listed under an "Other" category. Such activities included *acidize perforations, not stim-acid wash, not stim gravel pack,* etc. These listings under "Other" were included in totals for acidizing and gravel packing as well.

Sensitive receptors were sorted and counted by receptor type, either healthcare facility, hospital, school, preschool, or residence and also by address to determine both the number of reported sensitive receptor event exposures by type, and the number of unique sensitive receptors reported. Receptors were also sorted to determine the range of distances for exposures within 1,500 feet.

The Microsoft Access query function was used to double-check work done in Excel.

Chemical Reports

Chemical usage is organized by the event number for the event during which those chemicals were used. In order to separate reports for different chemicals, chemical data was sorted first by CASRN and then alphabetically by name to ensure that no individual chemical reports were excluded due to a wrongly reported CASRN or name, misspelling, or alternative chemical name. Using the COUNT function in Excel, the number of times a given chemical was used was counted. From this, the Top 12 air toxic chemicals and the total air toxics used were determined.

The total masses of chemicals used were determined using the SUM function in Excel for individual chemicals. In some cases, the mass of a given chemical used was not reported, but the density and volume of the chemical used was provided. In these cases, the density and the volume were multiplied to determine the mass of chemical used. Trade secret chemical usage was assumed to have occurred when the operator only provided a chemical family name for a chemical, but failed to disclose the chemical itself.

In the chemical reports, a chemical was labeled either with a "Y" for yes or a "N" for no to indicate if that chemical was considered to be an air toxic. Whether or not a chemical was labeled as an air toxic varied between reports, so it was necessary to reference a list of "Substances for Which Emissions Must Be Quantified" under Rule 1148.2 in order to determine whether or not a given chemical was an air toxic. Therefore, all of the air toxics in this report are found on that list which can be found at:

https://www.arb.ca.gov/ab2588/final/a1.pdf.
The Microsoft Access query function was used to double-check work done in Excel.

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