# Air Toxics One-Year Report: Oil Companies Used Millions of Pounds of Air-Polluting Chemicals in Los Angeles Basin Neighborhoods

An Analysis from the Center for Biological Diversity, Physicians for Social Responsibility – Los Angeles, Communities for a Better Environment, and the Center on Race, Poverty and the Environment

June 2014

One year after the South Coast Air Quality Management District (SCAQMD) began requiring the oil and gas industry to report the use of chemicals in certain well operations in the South Coast Air Basin, records show that oil companies have used 44 different air toxic chemicals more than 5,000 times in Los Angeles and Orange counties in the past 12 months.

The known air toxics most frequently used by oil companies in the Los Angeles air basin include crystalline silica, hydrofluoric acid, and formaldehyde. Air toxics are those chemicals considered to be among the most dangerous air pollutants because they have been proven to cause significant health harms, illness, and death. 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.

The oil industry has reported the use of more than 45 million pounds — or 22,500 tons — of air toxics in 477 hydraulic fracturing ("fracking"), acidizing and gravel packing operations in Los Angeles and Orange counties since mandatory reporting began in June of 2013. Oil companies have also claimed "trade secret" protection 5,050 times to conceal information on air toxics and other chemicals used. The data also shows that more than half of the fracking, acidizing, and gravel packing events reported by the oil industry have occurred within 1,500 feet of a home, school, or medical facility.

While the data collection's scope is limited, the information does provide insight into the oil and gas industry's previously hidden reliance on the use of air toxics in Los Angeles and Orange counties. Further, the data highlights the danger to which communities are exposed as these chemicals are transported and used and focuses attention on the critical need for policies that address the substantial harm that can be caused by the routine and accidental releases of these toxic air pollutants.

Finally, the data shows the oil industry's common use of "trade secret" claims to conceal the true scope and nature of the dangers to which their operations expose the people of Los Angeles and Orange counties.

## BACKGROUND

In April of 2013, the South Coast Air Quality Management District (SCAQMD) adopted Rule 1148.2, establishing the state's first notification and reporting requirements for selected enhanced oil and gas recovery activities.[1]

Starting June 4, 2013, SCAQMD required oil and gas well operators to submit reports ("Event Reports") that disclose where and when they plan to use the oil and gas recovery techniques of acidization, gravel packing, and fracking.

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, SCAQMD has made this data available online.

## FINDINGS

Based on a review of one year's worth of reports, SCAQMD data shows that oil and gas production employs an alarming amount of chemicals in communities in the South Coast Air Basin.[2] Many of these chemicals are known "air toxics" — chemicals that can cause serious health effects in people exposed to them.

Since reporting began, there have been 477 instances of fracking, acidizing, and gravel packing in the region. In total, at least 44 different air toxics have been used 5,068 times. The most commonly used air toxic, crystalline silica, was used more than 1,500 times.

### Hundreds of Well Stimulation Events

Well stimulation is any type of activity used to enhance the flow of hydrocarbons. The particular well stimulation techniques that are the focus of this reporting requirement have been used hundreds of times in Los Angeles and Orange counties over the past year. The data shows that more than once per day, on average, chemicals are being injected into an oil well in Los Angeles or Orange County.

| Well Stimulation | Reported Occurrences |
|---|---|
| Acidizing | 314 |
| Gravel Packing | 149 |
| Fracking | 14 |
| **Total[3]** | **477** |

[1] SCAQMD Rules and Regulations, Rule 1148.2, available at http://www.aqmd.gov/rules/reg/reg11/r1148-2.pdf

[2] The South Coast Air Basin covers all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino Counties. The data shows that all of the activity reported occurred in Los Angeles and Orange Counties.

[3] The number is the difference of the number of "Original" reports less the number of "Cancellation" reports. "Revision" reports were not counted as they typically would not significantly increase or decrease the total number of well stimulation events.

**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. Since event reporting began in early June 2013, there have been approximately 314 acidizing events reported in Los Angeles and Orange counties.[4]

This number is likely less than the actual number of acidizing events that have occurred.[5] Several reports disclose that the operator used acid for an "acid wash" or "acid perforation," but failed to check "Y" under the acidizing query on the reporting form. Thus, even though large amounts of acid, chemicals, and water have been pumped into the ground, it is not counted on aggregate data searches because the operator did not check the "acidizing" box on the form. This analysis did not attempt to correct for this discrepancy and, therefore, may underreport the actual number of acidizing events.

**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. Since June 2013, there have been approximately 149 gravel packing events reported in Los Angeles and Orange counties. Again, some reports indicate that gravel packing has occurred, but the operator did not categorize it as gravel packing on the report. For example, an operator reported "Not Stim[ulation] – Gravel Pack," but left the gravel packing box unchecked. Thus, like acidizing, even though gravel packing has occurred, it is not always included in aggregate data searches because the operator did not check the gravel packing box on the form. Consequently, the actual number of gravel packing incidents may be higher.

**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. Since June 2013, there have been approximately 14 fracking events reported in Los Angeles and Orange counties.

### Most Common Air Toxics

A review of the data from June 4, 2013, through June 3, 2014, shows that at least 44 different chemicals reported as being air toxics were used by operators. These chemicals were used in at least 5,068 instances. More than 45 million pounds — or 22,500 tons — of these air toxics were used.

[4] This includes reports of acidizing, acid matrix, acid maintenance, and acid fracturing.

[5] Rule 1148.2 defines "Acidizing" as "a treatment of the wellbore or reservoir formation with an acid to either clean out scale, damage, or other debris in the well, or react with the soluble substances in the formation to improve permeability and enhance production of oil and gas." Rule 1148.2(c)(1).

The 12 most commonly used air toxics are shown in the chart below:

| **The 12 Most Commonly Used Air Toxins in Unconventional Oil Production in the L.A. Basin[6]** | | | | |
|---|---|---|---|---|
| **Rank** | **Chemical** | **Number of Instances Used[7]** | **Total amount by mass (lbs.)** | **Known Health Effects[8]** |
| 1 | Crystalline Silica[9] | 1590 | 25,497,493 | Harmful to skin, eyes, and sensory organs, respiratory system, immune system and kidneys; mutagen. |
| 2 | Methanol | 810 | 166,751 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, reproductive and cardiovascular system; mutagen, developmental inhibitor and endocrine disruptor. |
| 3 | Hydrochloric Acid | 498 | 10,897,302 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, immune system, cardiovascular system and blood. |
| 4 | Formaldehyde | 232 | 32,519 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, reproductive system and cardiovascular system; mutagen, developmental inhibitor. |
| 5 | Amorphous Silica[10] | 215 | 750,300 | Harmful to skin, eyes and other sensory organs, respiratory system, |

[6] Records from July 1, 2013 through May 25, 2014

[7] In some cases, the same chemical ingredient was listed as being used multiple times in the same chemical report for different purposes. In such cases, each use is counted separately.

[8] Unless otherwise noted, health effects are documented by TEDX Endocrine Disruptor Exchange. Spreadsheet of health effects listed by chemical is available at http://endocrinedisruption.org/chemicals-in-natural-gas-operations/chemicals-and-health.

[9] Includes reported uses of crystalline silica; crystalline silica (quartz); crystalline silica, quartz (SIO2); crystalline silica, quartz; crystalline silica (SI [sic]; quartz (SIO2); silica, crystalline, quartz; crystalline silica tridymite; tridymite; tridymite (SIO2), crystalline silica cristobalite, cristobalite (SIO2).

[10] Includes reports listing amorphous silica, silica, silica fumed, amorphous silica fumed, and fumed silica.

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| | | | | gastrointestinal system and liver; linked to lung cancer. |
| 6 | Hydrofluoric Acid | 204 | 5,454,496 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, reproductive system and cardiovascular system; mutagen, developmental inhibitor. |
| 7 | Naphthalene | 185 | 25,014 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, cardiovascular system; mutagen, endocrine disruptor, developmental inhibitor. |
| 8 | 2-Butoxy Ethanol[11] | 177 | 69,988 | Harmful to skin, eyes and other sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, reproductive system and cardiovascular system; mutagen, developmental inhibitor and endocrine disruptor; linked to liver cancer. Also linked to adrenal tumors.[12] |
| 9 | Alumina / Aluminum Oxide | 145 | 761,889 | Harmful to skin, eyes and other sensory organs, respiratory system, and brain and nervous systems. |
| 10 | Xylene | 116 | 97,178 | Harmful to skin, eyes and other sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, immune system, kidneys, reproductive and cardiovascular system; developmental inhibitor and endocrine disruptor. |
| 11 | Glutaral/ Pentanedial | 116 | 67,298 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, |

[11] Includes reports listing 2-butoxyethanol and ethylene glycol monobutane ether

[12] U.S. EPA Integrated Risk Information System, Ethylene glycol monobutyl ether (EGBE)(2-Butoxyethanol) (CASRN 111-76-2), available at http://www.epa.gov/iris/subst/0500.htm; *See also* Abraham Lustgarten, ProPublica, Buried Secrets: Is Natural Gas Drilling Endangering US Water Supplies?

| | | | | |
|---|---|---|---|---|
| | | | | brain and nervous system, immune system, kidneys, reproductive and cardiovascular system; mutagen, developmental inhibitor and endocrine disruptor. |
| 12 | Ethylbenzene | 111 | 81,934 | Harmful to skin, eyes, and sensory organs, respiratory system, gastrointestinal system and liver, brain and nervous system, kidneys, reproductive system and cardiovascular system; suspected carcinogen, mutagen, endocrine disruptor, developmental inhibitor. |

**Chemicals Used Close to Schools, Hospitals and Homes**

SCAQMD data shows that roughly 265 reported well stimulation events occurred at sites within 1,500 feet of at least one hospital, preschool, or residence — and some were as close as 12 feet. Many wells are close to several facilities housing people especially vulnerable to toxic chemicals. For example, Freeport-McMoRan Oil and Gas Company conducted three acidizing events at its Jefferson production site, a cluster of wells located in a densely populated part of Los Angeles. Those chemical-intensive activities took place just 85 feet from homes, 145 feet from a church, and 770 feet from an elementary school. Use of industrial chemicals near children and the elderly is especially concerning because chemicals may have relatively severe health effects in these vulnerable populations compared to the general adult population. Medical and health professionals warn of substantial and detrimental health risks for surrounding communities.

**Voices from the Medical Community**

*James Dahlgren, M.D.*

“Children, the elderly, and people who are already sick are especially at risk from exposures to air toxics. Data collected over the years strongly supports the need for special attention to be paid to these populations because they tend to have reactions to chemicals at lower levels than the general adult population.”

**Fig. 1: The Jefferson wells in Los Angeles and their proximity to surrounding receptors.**


In another example, Brea Canon Oil Company acidized its Joughlin 3-D well located in the middle of a residential neighborhood in Harbor City. The nearest home was only 50 feet from the well where dozens of toxic chemicals were used to acidize the well.

**Figure 2: Joughlin 3-D well and its proximity to residences in Harbor City, California**

**"Trade Secret" Claims Conceal Key Information**

Oil industry reporting may significantly understate the frequency and volume of chemical use because operators have withheld chemical information from their reports in 5,050 instances.

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 SCAQMD 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."

**Chemical Profiles**

Formaldehyde: A colorless, strong-smelling gas, formaldehyde is used as a corrosion inhibitor and dispersant during certain oil extraction activities. Formaldehyde is a known carcinogen known to increase the risk of lung cancer and leukemia. Acute exposure may result in headache, nausea, vomiting, pneumonia, dyspnoea, respiratory depression, pulmonary oedema, and burning of the nose, eyes, and throat.

Trade secret claims can be used by companies to hide their proprietary information, but such protections do not apply to chemical identities and concentrations related to well stimulation. California state law clearly states:

> Notwithstanding any other law or regulation, none of the following shall be protected as a trade secret: [t]he identities of the chemical constituents of additives, including [chemical abstract service] identification numbers.[13]

Thus, none of the 5,050 claims for a trade secret is valid under state law. Despite the clear and explicit statute, operators continue to withhold chemical information by submitting claims of trade secrecy for a large number of chemicals, leaving the public with no knowledge of what chemicals are being used or in what quantities. Despite multiple requests[14] to SCAQMD asking for public disclosure of all chemical identities, SCAQMD has so far offered no information or explanation as to why the information remains withheld from the public.

[13] California Public Resources Code § 3160(j)(2).

[14] The Center for Biological Diversity and Physicians for Social Responsibility – Los Angeles first sent a request under the California Public Records Act to SCAQMD on October 2, 2013. The organizations asked for chemical information reported under Rule 1148.2, including chemicals claimed to be trade secrets.

**Chemical Profiles**

Hydrofluoric Acid (hydrogen fluoride): Commonly used in acidizing to help dissolve materials inside a well or the underground shale formation, hydrofluoric acid is extremely corrosive and can cause severe skin burns upon contact. The chemical can cause a variety of health effects (see table above) and even cause death through skin exposure or inhalation. Releases of this chemical causes extremely dangerous clouds to form and drift along the ground without dispersing. Because of its highly dangerous properties, the SCAQMD adopted a rule to phase out its use in refineries.

In addition, many of the trade-secret protected chemicals are marked as an air toxic. Of the 5,050 instances in which an operator withheld the identity of a chemical, 1,037 are marked as being an air toxic. Another 663 trade secret claims provide no indication of whether it is an air toxic or not. This means that as many as one third of that group of chemicals could be additional, undisclosed air toxics being used in communities.

Furthermore, the air toxic designation of withheld chemicals is not viewable when individual reports are viewed on the SCAQMD website. Thus, a chemical under a trade secret claim may show a "Y," indicating an air toxic, when downloaded from the site with other well information, but when the individual report is viewed on the SCAQMD website, the box indicating the presence of an air toxic next to the same trade secret claim is left unchecked. This means a person looking up a particular well stimulation report online will not know whether any of the trade secret claims are hiding the use of an air toxic. This seems to be a limitation in SCAQMD's online reporting interface.

**Even More Chemicals Are Used In Other Stages of Oil and Gas Development**

It should be noted that SCAQMD's data captures only those chemicals used during well stimulation, *not* those used during other stages of development, such as site construction, drilling, well completion, conventional extraction, transportation, processing and refining, and end-use combustion. While SCAQMD has not required reporting for these chemicals, many studies show significant public health and safety concerns associated with oil and gas activity as a whole.

For example, independent air quality sampling from Colorado showed that there was a spike of harmful air emissions during the initial drilling phase of a well. Mixtures known as "drilling muds," which contain a number of chemicals, are used to facilitate the drilling process. The emitted air toxics included volatile organic compounds and polycyclic aromatic hydrocarbons.[15] The study found that harmful chemicals were emitted throughout the process. Air sampling detected many chemicals known to have harmful human health effects, including acetaldehyde, benzene, formaldehyde, isoprene, naphthalene, and many more.[16]

[15] Theo Colborn et al., "An Exploratory Study of Air Quality near Natural Gas Operations," Human and Ecological Risk Assessment: An International Journal (November 26, 2012).
[16] Colborn, pp. 29-32, Table 4.

A separate study showed that toxic air emissions from well sites are likely to be far greater than official estimates. The study found that well sites were emitting benzene, a known carcinogen, at a rate seven times higher than U.S. EPA estimates.[17] The study also found that methane, which can lead to increased levels of harmful ground-level ozone and smog, was emitted at rates three times higher than U.S. EPA estimates.[18]

Another chemical common in oil and gas operations is methylene chloride. Exposure to this highly volatile chemical can lead to damage to sensory organs, the liver, kidneys, respiratory system, immune system, cardiovascular system, brain and nervous system, gastrointestinal system, and endocrine system.[19] It is also considered a potential carcinogen.[20] Methylene chloride is thought to be widely used as a cleaning agent for equipment on oil and gas production sites. Because its use is separate from well stimulation fluid, operators do not report its use, yet studies have shown that it is prevalent in air samples taken close to oil and gas operations.[21]

### Nearby Communities at Risk of Exposure

These air toxics, which can be emitted before, during, and after well stimulation, are endangering the health of nearby residents. In Los Angeles, the AllenCo oil facility has been cited for multiple air emission violations. The pollution has been linked to nosebleeds, headaches, breathing trouble, and nausea suffered by nearby residents, leading to hundreds of complaints to SCAQMD.[22] After AllenCo was forced to halt operations, the *Los Angeles Times* revealed that reports of illnesses had diminished significantly. Whether or not well stimulation is used, oil and gas operations are responsible for emitting air toxics throughout the process.

## CONCLUSION

The data reported to SCAQMD, while incomplete in many ways, shows extensive and widespread use of harmful chemicals in the Los Angeles air basin. The pervasive and persistent use of these chemicals threatens to contaminate local air quality and put communities' health and safety at risk. The reporting requirements have proven the need for immediate action to protect the public.

[17] Gabrielle Petron et al., "A New Look at Methane and Non-Methane Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin," Journal of Geophysical Research (2014), DOI: 10.1002/2013JD021272.
[18] Id.
[19] Colborn, pp. 29-32, Table 4.
[20] U.S. Department of Health and Human Services, National Toxicology Program, "Report on Carcinogens, Twelfth Edition: Dichloromethane," (2011).
[21] Colborn. at 10.
[22] Louis Sahagun, "Chemical Odor, Kids' Nosebleeds, Few Answers in South L.A. Neighborhood," *Los Angeles Times* (September 21, 2013).