

Annual Review Of Appendix O MAACs

Oklahoma Department
of
Environmental Quality

July 2023

Summary

The Technical Projects & Resources Section of the Air Quality Division is charged with an annual review of the toxic air contaminants (TAC) Maximum Acceptable Ambient Concentrations (MAAC) found in Appendix O of the Air Quality Regulations. This review consists of recommending any changes to Appendix O and updating the documentation for each TAC and its corresponding MAAC. After a review of EPA's IRIS (Integrated Risk Information System) database and Appendix O, only the risk factor for Ammonia has changed. Staff will continue to review EPA information and our monitored data. A decision as to whether any changes will be made to either the TAC list or the MAAC levels will be made at a later date.

This is a rolling 10-year review of monitored toxics results. The monitoring data for this assessment includes January 2013 through December 2022. Due to the one-year lag in emissions reporting, that portion of this assessment covers 9 years and includes 2013 through 2021.

Monitoring site locations changed during the timeframe covered in this review. The Division operates some toxics monitors for longer term trends and then some for shorter term special purpose locations. The following map indicates monitor locations that were active at any point during the study period and the table represents the site name legend for the map.

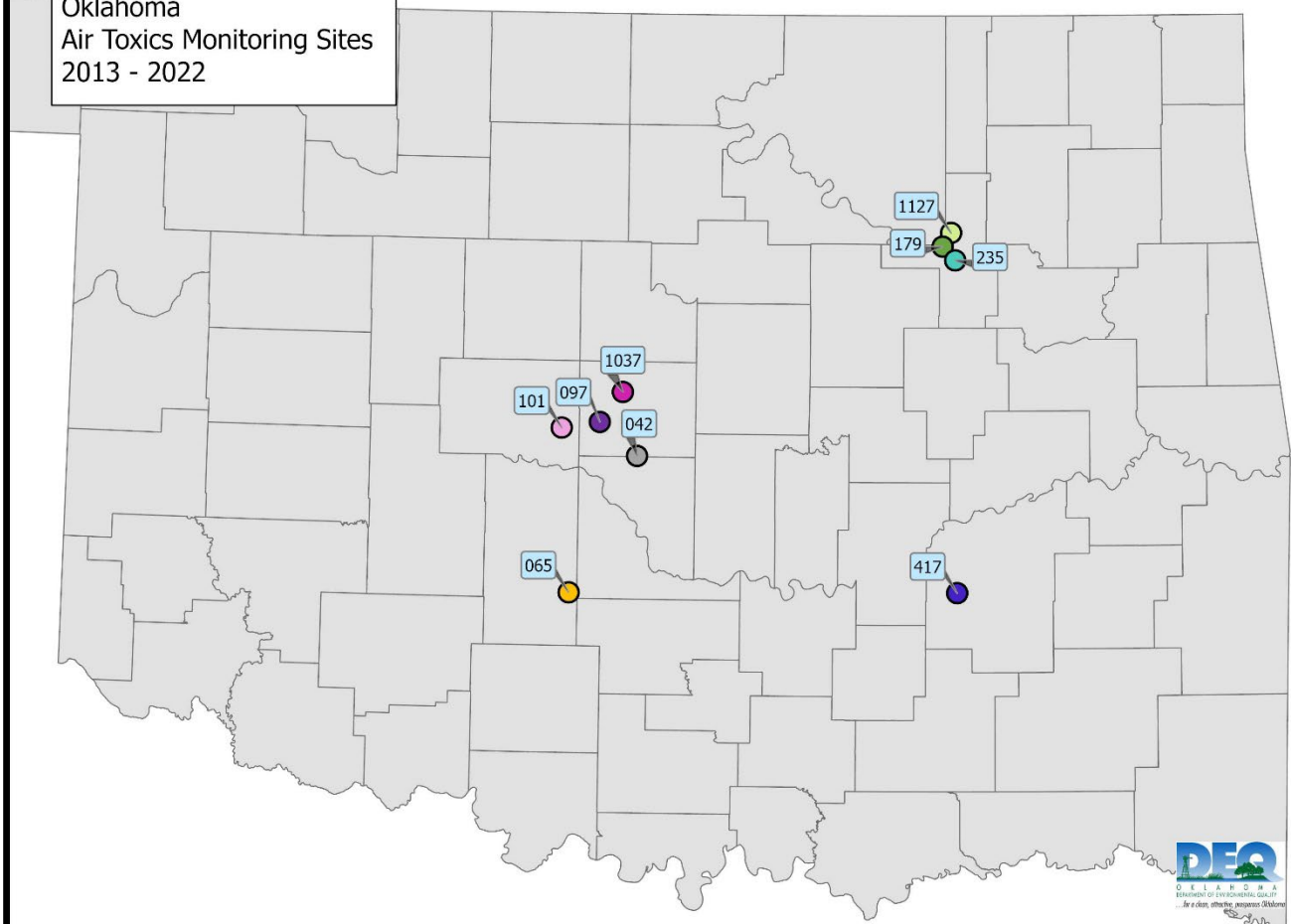
The blue chart presents the 10-year average for each TAC normalized by percent of its respective MAAC. The bar for Chromium is biased high because the MAAC is for Chromium VI specifically, but the monitored data includes all Chromium compounds. All other TAC are below 12% of MAAC with the exception of Formaldehyde which is under 38% of MAAC.

The yellow chart presents the highest annual average across the 10-year study period for each TAC normalized by percent of its respective MAAC. Again, the bar for Chromium is biased high because the MAAC is for Chromium VI specifically, but the monitored data includes all Chromium compounds. This chart shows that even the highest annual averages are well below the standards.










The final map in this section shows the statewide location of the facility reporting the highest emissions for each TAC during the study period and the year in which that report occurred. This information is also summarized in the table below the map.

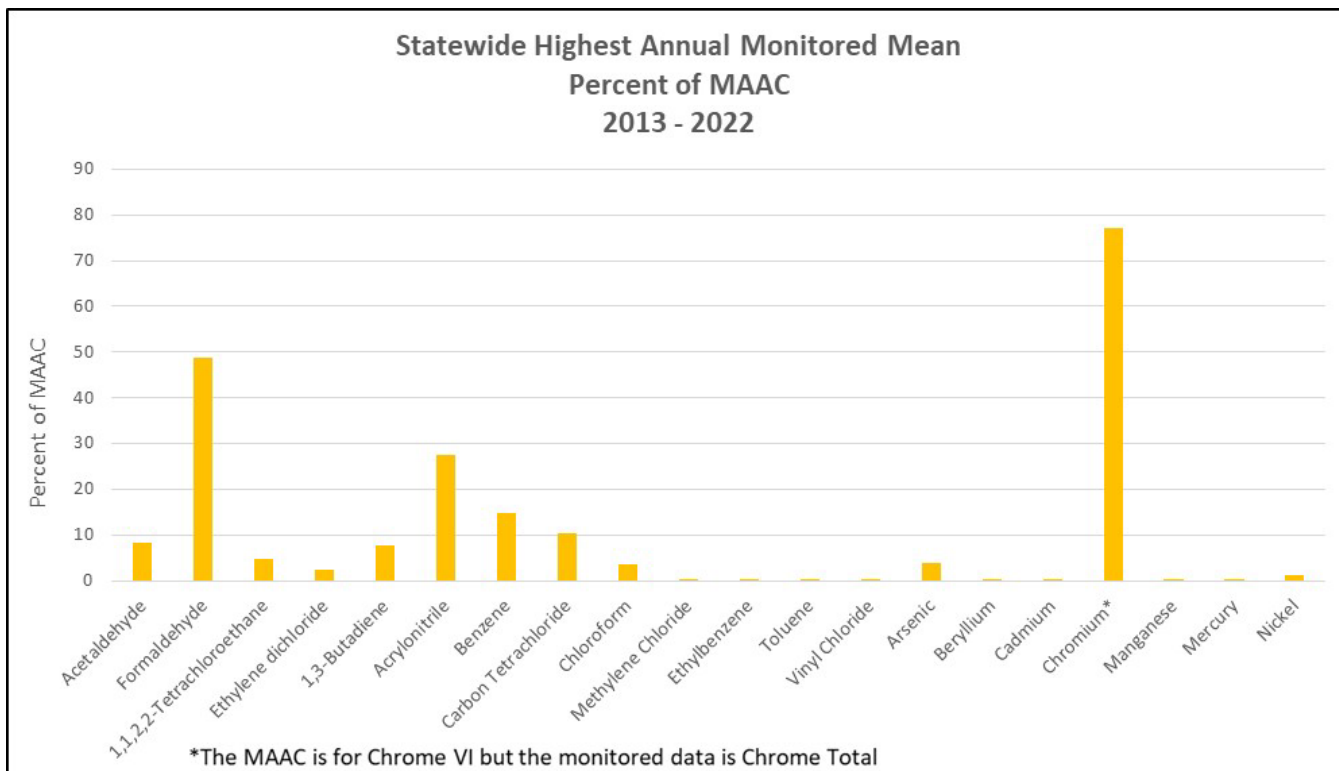
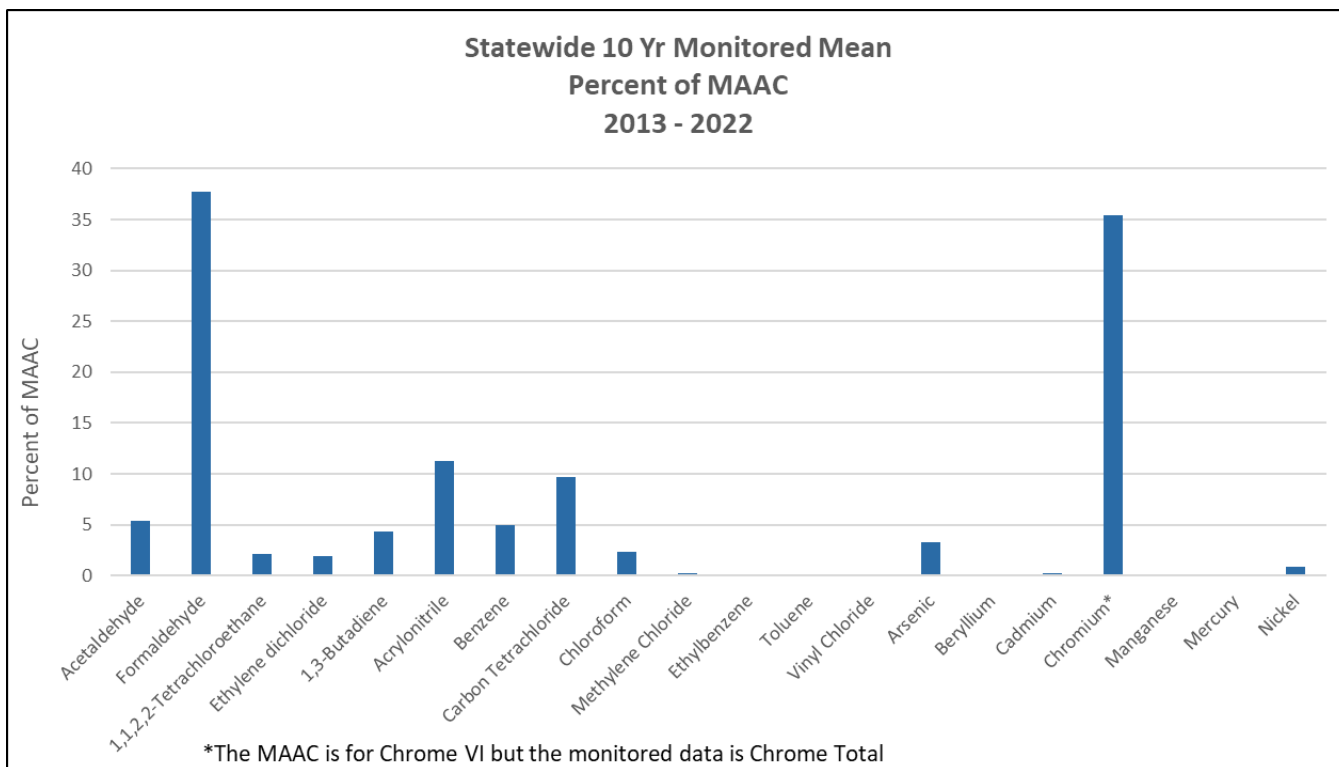
The remaining pages are the TAC specific data review. Each TAC review includes a basic summary, a 10 year monitored data chart, and a 9-year reported emissions summary.

Oklahoma
Air Toxics Monitoring Sites
2013 - 2022



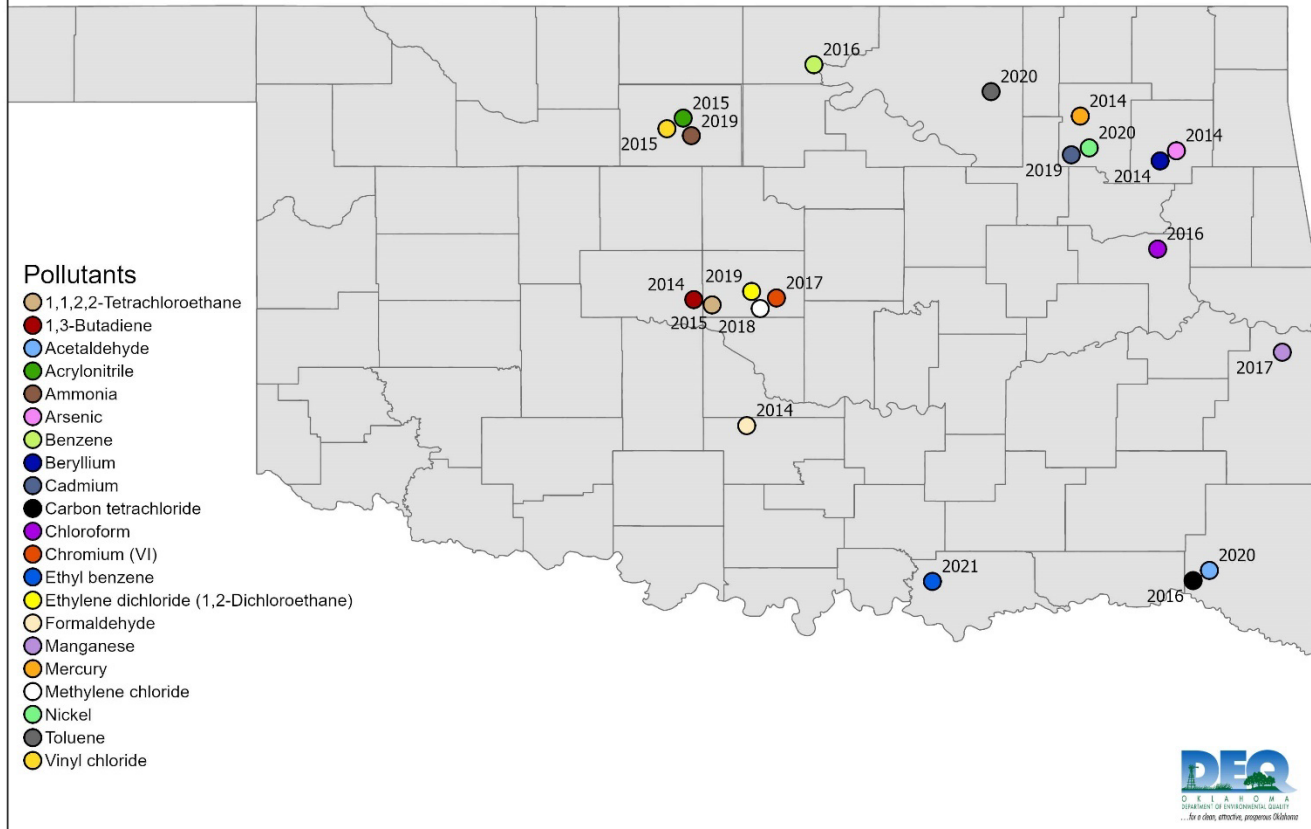
Monitor Site Legend

	Site Number	Site Name			Site Number	Site Name
	101	Yukon			179	Tulsa Riverside
	1037	OKC OK Christian			1127	Tulsa NCORE
	097	OKC Near Road			235	Tulsa Water Dept
	042	Tinker South			417	Haywood
	065	Bradley				



Highest 9 Yr Appendix O Emissions

2013 - 2021



Highest 9 Yr Reported Emissions			
Year	County	Pollutant	Emissions (tons)
2020	McCurtain	Acetaldehyde	21.033
2015	Garfield	Acrylonitrile	1.004
2014	Mayes	Arsenic	0.696
2016	Kay	Benzene	19.62
2014	Mayes	Beryllium	0.038
2014	Canadian	1,3-Butadiene	1.432
2019	Rogers	Cadmium and Cadmium cmpds	0.131
2016	McCurtain	Carbon tetrachloride	1.452
2016	Muskogee	Chloroform	5.071
2017	Oklahoma	Chromium VI	3.968
2019	Oklahoma	1,2-Dichloroethane	0.151
2014	Garvin	Formaldehyde	48.419
2018	Oklahoma	Methylene chloride	13.88
2020	Rogers	Nickel	5.424
2015	Oklahoma	1,1,2,2-Tetrachloroethane	0.287
2015	Garfield	Vinyl chloride	1.163
2019	Garfield	Ammonia	2276.891
2021	Bryan	Ethylbenzene	14.253
2017	Le Flore	Manganese	28.084
2014	Rogers	Mercury	0.235
2020	Osage	Toluene	400.310

ACETALDEHYDE

CAS # 75-07-0

SYNONYMS: acetic aldehyde, ethyl aldehyde

DESCRIPTION: formula C_2H_4O , mol. wt. = 44.06 Colorless, fuming liquid with pungent odor, fruity smell at lower concentrations.

CARCINOGEN status (IRIS): PROBABLE

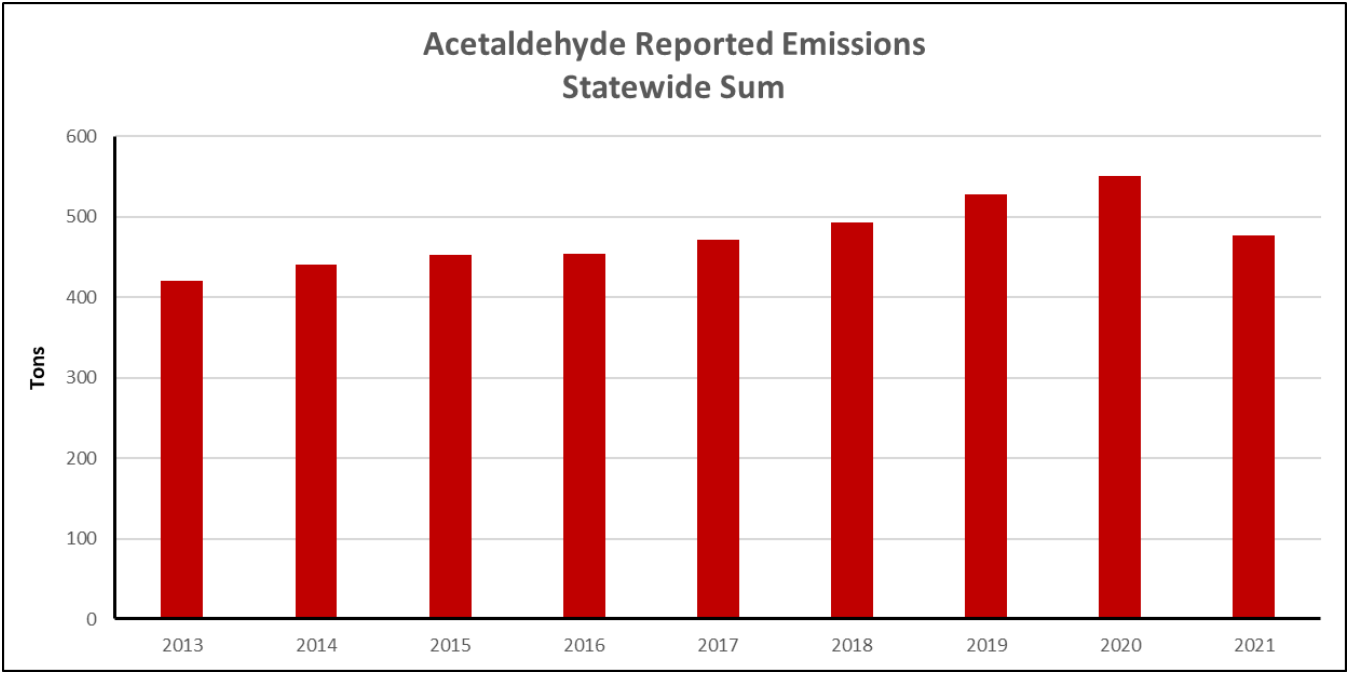
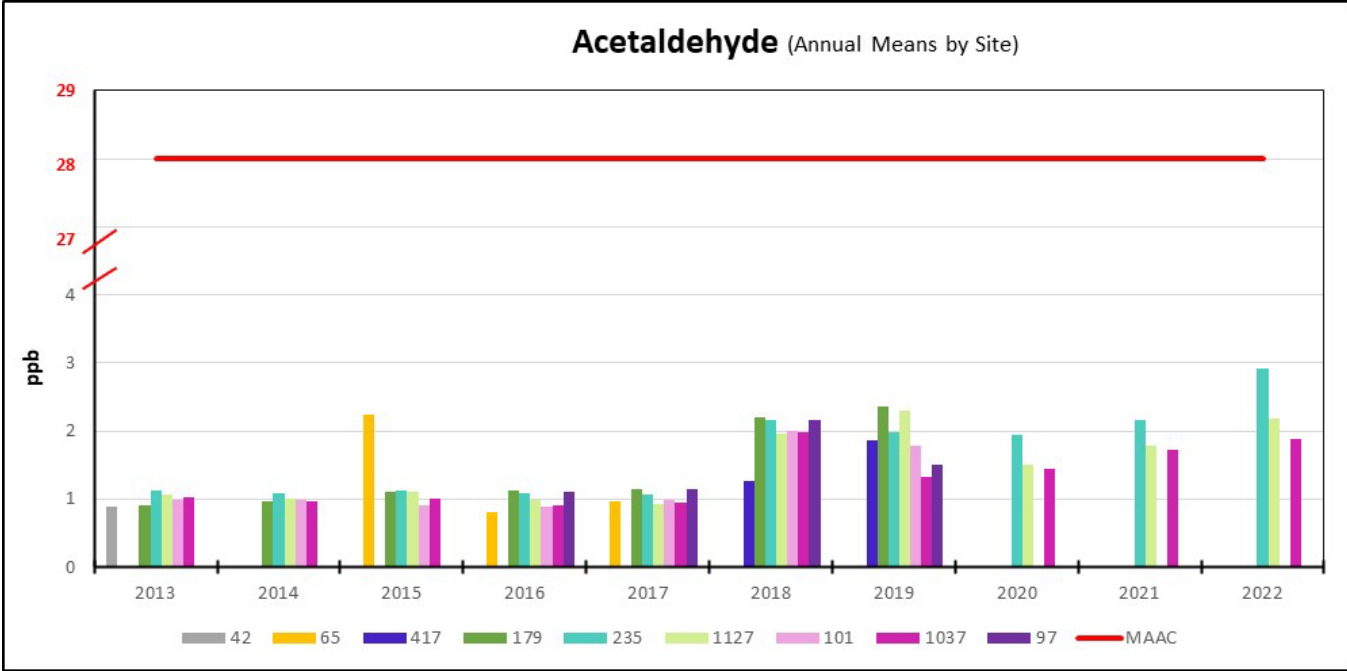
MAAC: 28 ppb ($50 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes, combustion processes and especially gasoline combustion. Acetaldehyde is also formed by photochemical oxidation and naturally through plant respiration. The 2021 Air Quality Emission Inventory showed 476.033 tons reported. The AQD does not have accurate inventories for the mobile, photochemical and biogenic emissions.

HEALTH EFFECTS: Acetaldehyde is listed as a probable human carcinogen (nasal) based on animal studies. Non-cancer health effects are irritation of eye, skin and respiratory tract, with prolonged exposure leading to more serious effects.

MONITORING METHOD: EPA TO-11A.



ACRYLONITRILE

CAS # 107-13-1

SYNONYMS: 2-propenenitrile; vinyl cyanide; cyanoethylene; Acritet; Fumigrain

DESCRIPTION: formula C_3H_3N , mol. wt. = 53.06 Colorless, very volatile liquid, somewhat explosive.

CARCINOGEN status (IRIS): PROBABLE

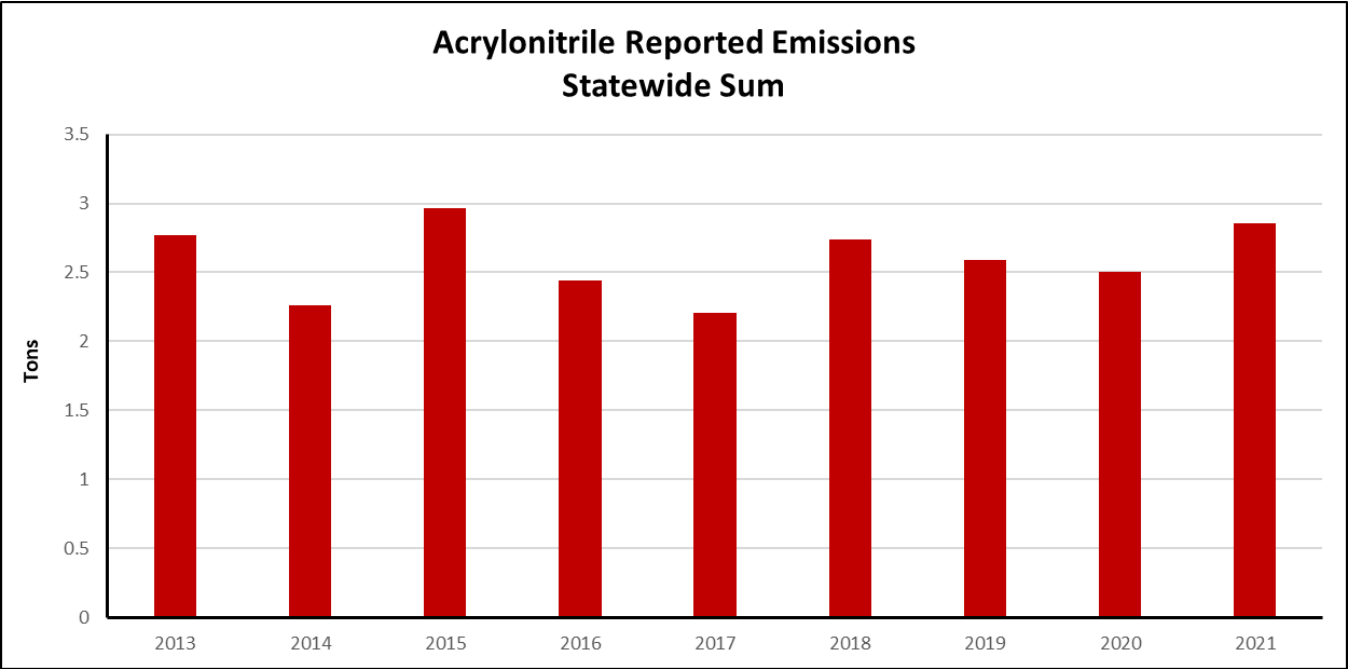
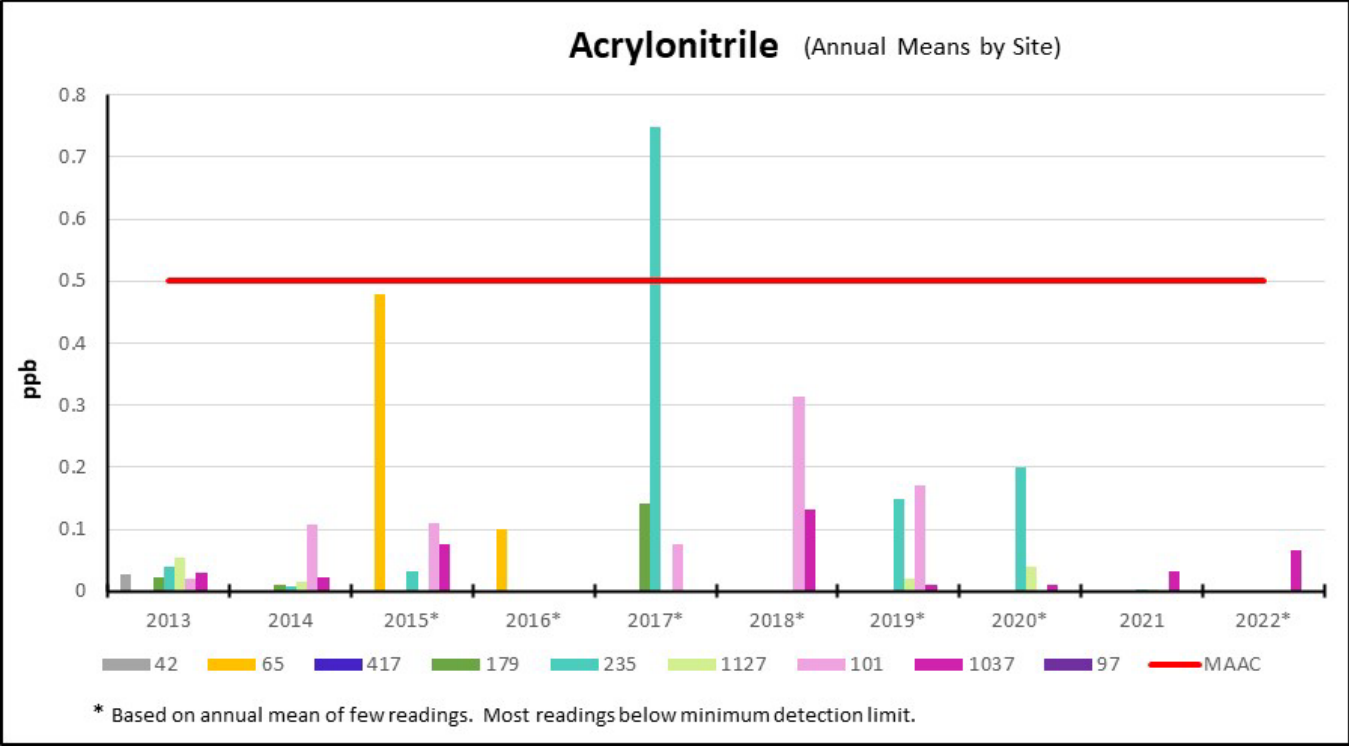
MAAC: 0.5 ppb ($1.0 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Production of acrylic fibers, other industrial, chemical, and manufacturing processes, and gasoline combustion. The 2021 Air Quality Emission Inventory showed 2.86 tons reported. The AQD does not have an accurate emission inventory for acrylonitrile from mobile sources.

HEALTH EFFECTS: Acrylonitrile is listed as a probable human carcinogen (lung cancer) based on some worker exposure and animal studies. Non-cancer health effects: Acrylonitrile is a central nervous system depressant and a respiratory irritant that is metabolized to cyanide. Symptoms include headache, dizziness, nausea, feelings of apprehension and nervous irritability, muscle weakness, cyanosis, and convulsions.

MONITORING METHOD: EPA TO-15.



AMMONIA

CAS # 7664-41-7

SYNONYMS: anhydrous ammonia

DESCRIPTION: formula $\text{H}_3\text{-N}$, mol. wt. = 17.03 Colorless, corrosive alkaline gas with very pungent odor.

CARCINOGEN status (IRIS): Not assessed

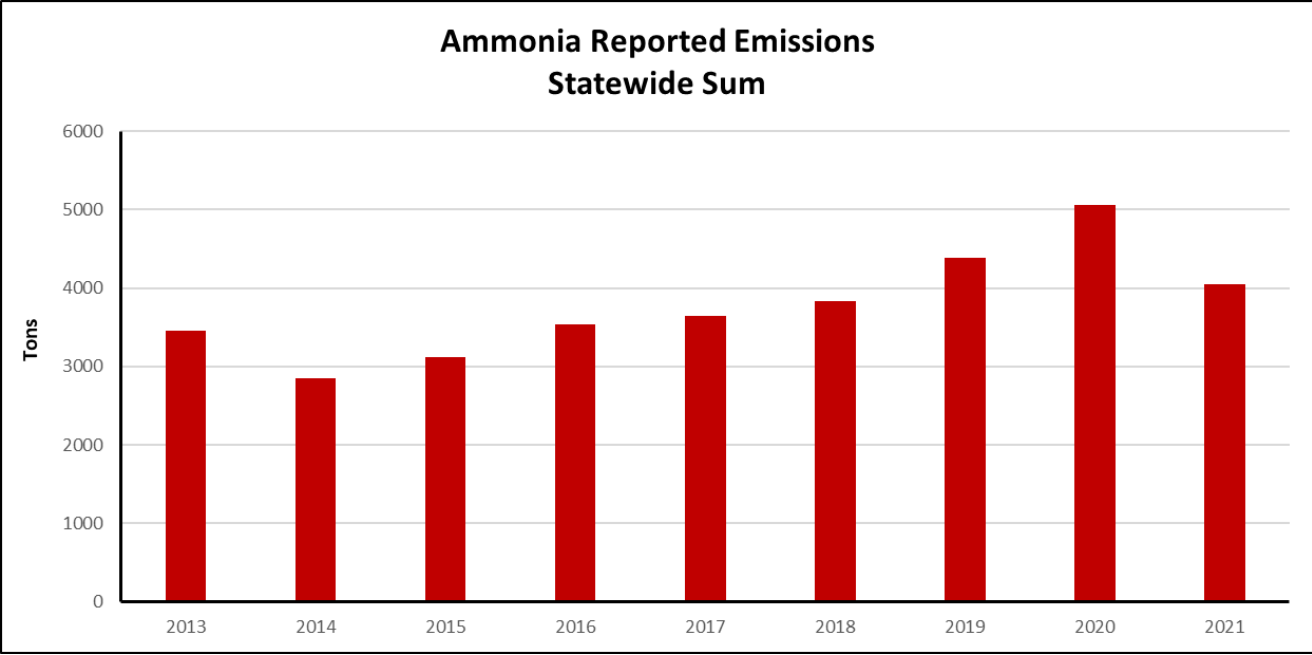
MAAC: 2,500 ppb (1742 $\mu\text{g}/\text{m}^3$) 24-hour average

The MAAC would be based on the No-Observed Adverse Effect Level (NOAEL) Human Equivalent Concentration (HEC) (2700 ppb), but in 2005 the MAAC set by SC 41 was 2500 ppb. To avoid “back-sliding” the level was kept at the SC 41 MAAC of 2500 ppb in Appendix O.

SOURCES: Many industrial, chemical, and manufacturing processes, especially fertilizer production and agricultural processes. The 2021 Air Quality Emission Inventory showed 4048.509 tons reported.

HEALTH EFFECTS: Strong irritant to eye and respiratory tract, with higher exposures leading to more severe effects.

MONITORING METHODS: EPA IO-4 and 4.2 (Manual Diffusion Denuder System) Currently, Ammonia is not included in the toxics monitoring.



ARSENIC Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula As- There are many inorganic compounds of arsenic.

CARCINOGEN status (IRIS): KNOWN

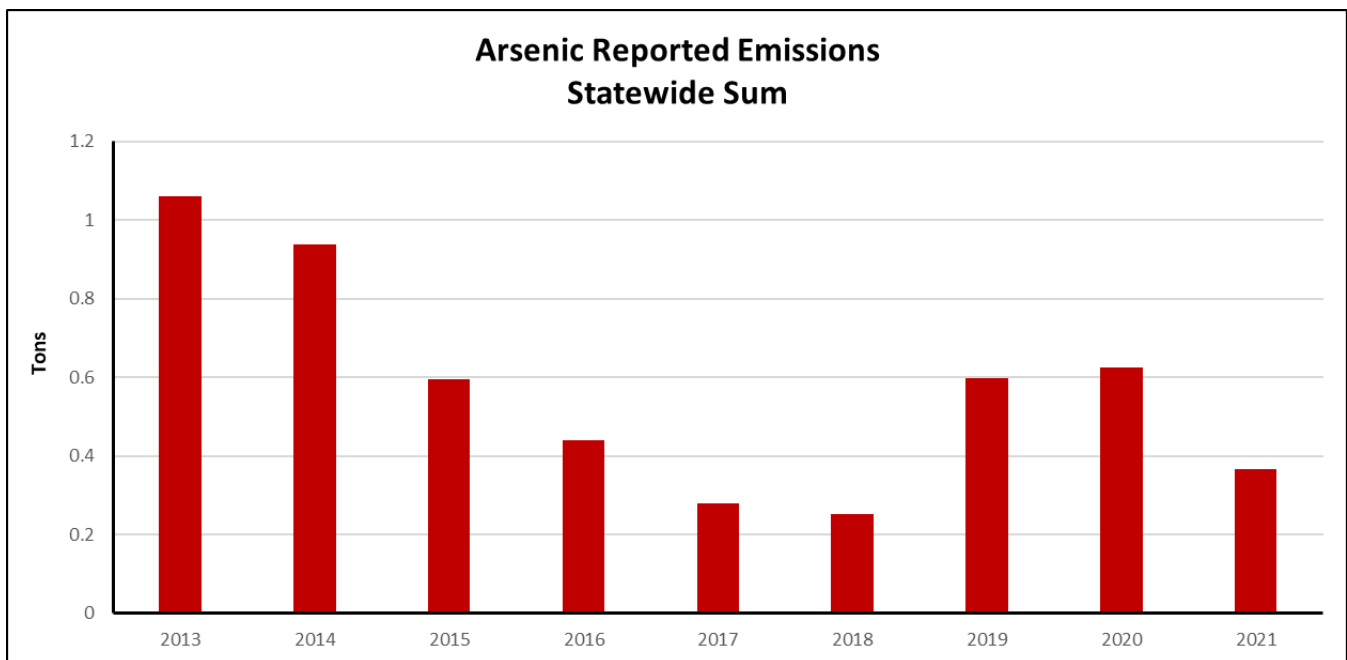
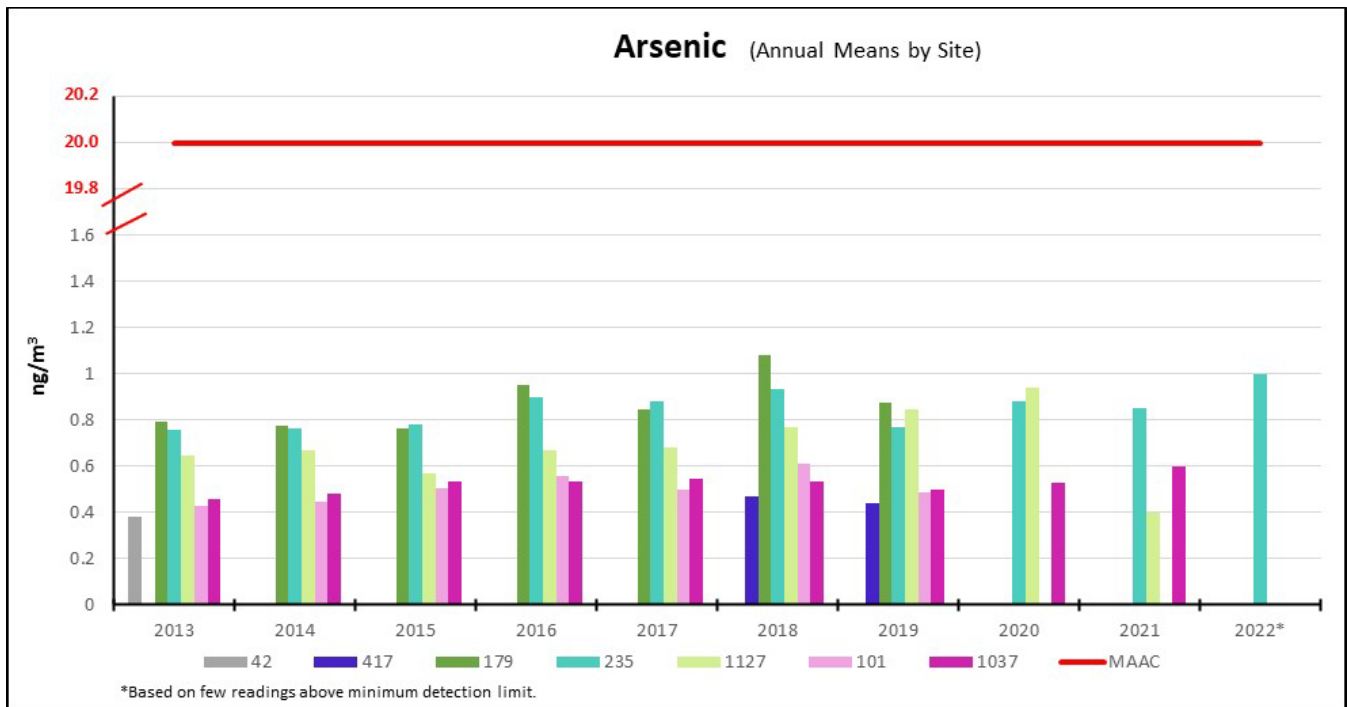
MAAC: 0.02 $\mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Combustion and high-temperature processes, some metal-working processes. Organic arsenic compounds are used in pesticides. The 2021 Air Quality Emission Inventory showed 0.367 tons reported. No significant mobile sources.

HEALTH EFFECTS: Well-documented carcinogen, especially respiratory cancers.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



BENZENE

CAS # 71-43-2

SYNONYMS: no common synonyms

DESCRIPTION: formula C_6H_6 , mol. wt. = 78.12 Colorless, volatile liquid with strong aromatic odor.

CARCINOGEN status (IRIS): KNOWN

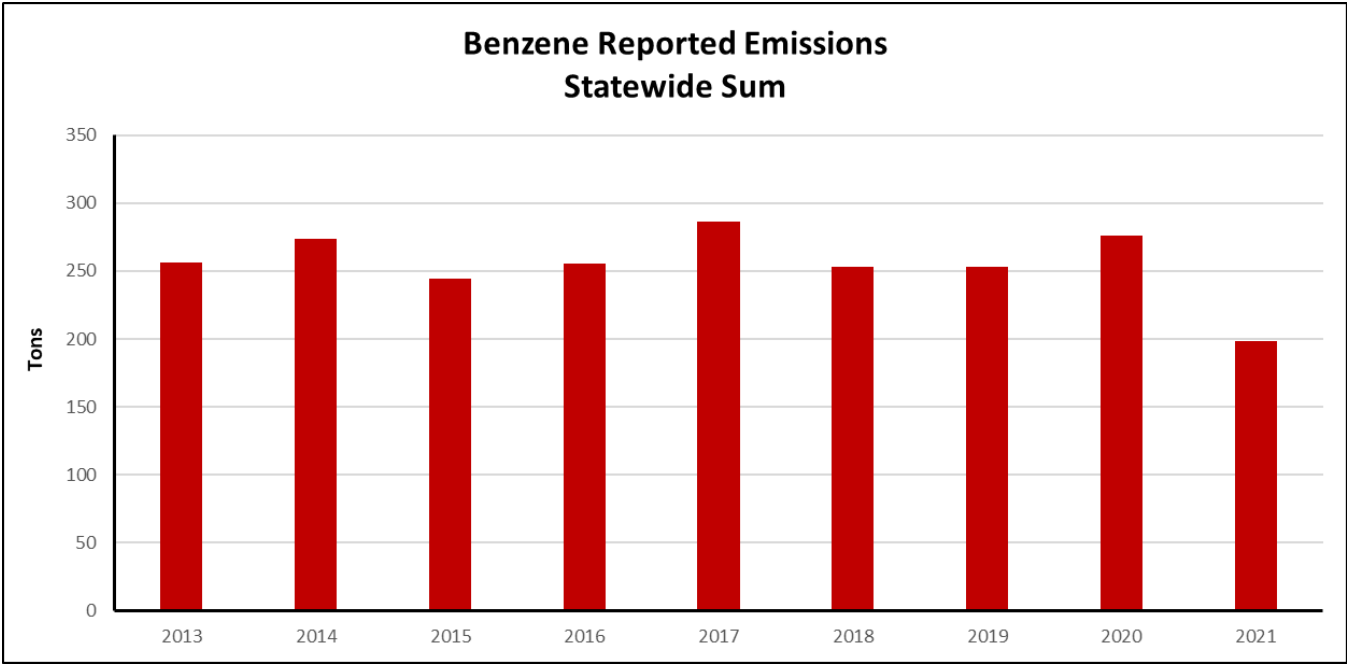
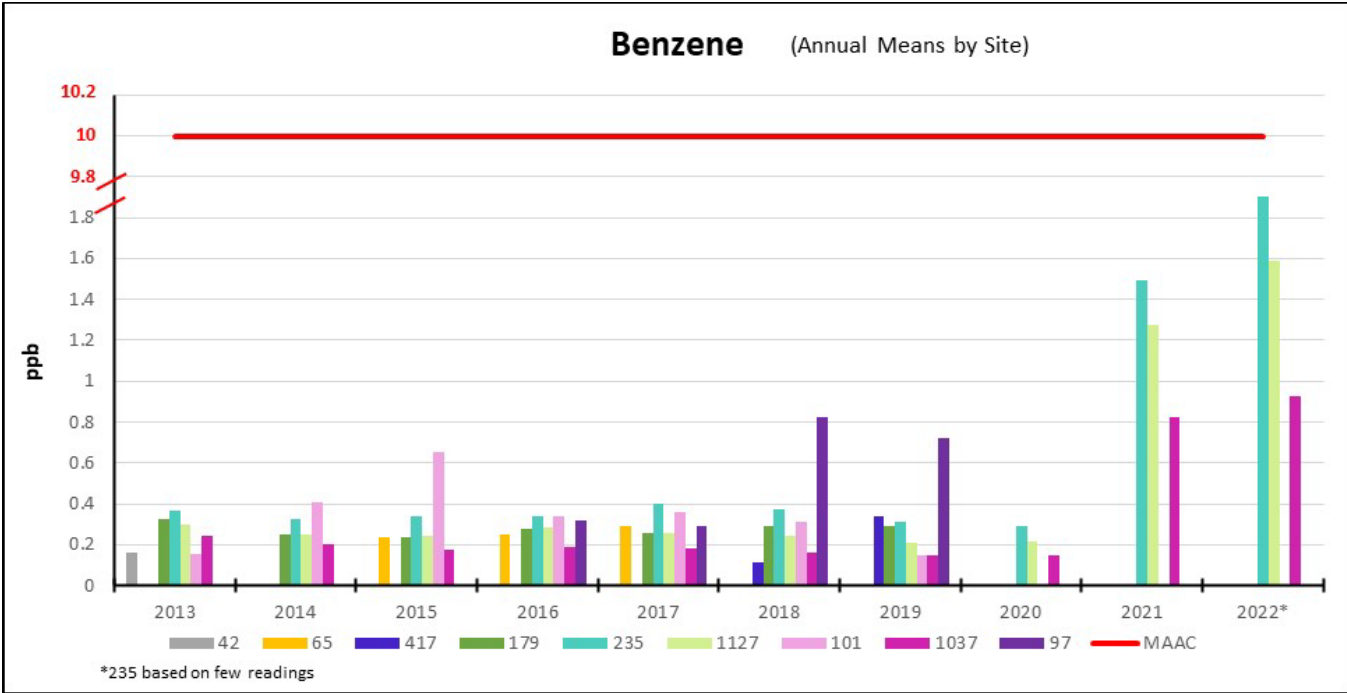
MAAC: 10 ppb ($30 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value. Benzene is unique because the IRIS 10^{-4} inhalation risk value is stated as a range of 4 ppb to 14 ppb. The MAAC is the midpoint of that range.

SOURCES: Many industrial, chemical, and manufacturing processes and gasoline combustion. The 2021 Air Quality Emission Inventory showed 198.58 tons reported. The AQD does not have an accurate emission inventory for benzene from mobile sources.

HEALTH EFFECTS: Well-documented carcinogen, especially leukemia.

MONITORING METHOD: EPA TO-15.



BERYLLIUM Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formulas Be-, there are many compounds of beryllium.

CARCINOGEN status (IRIS): PROBABLE

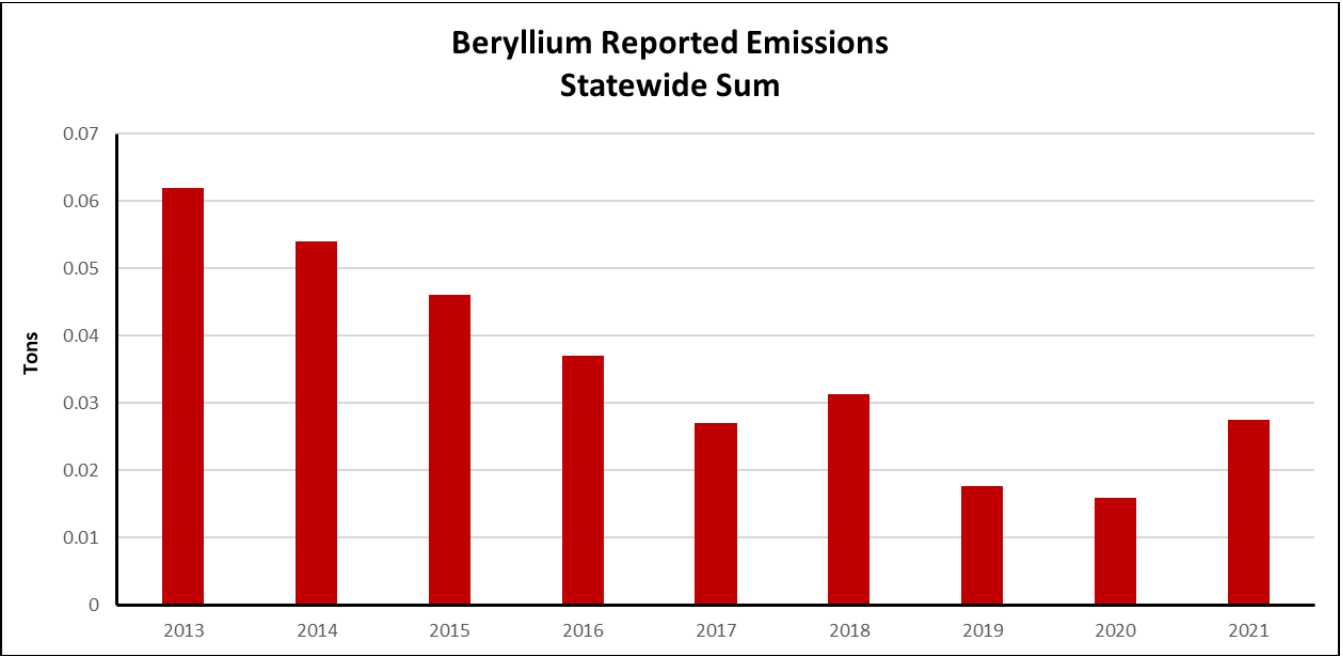
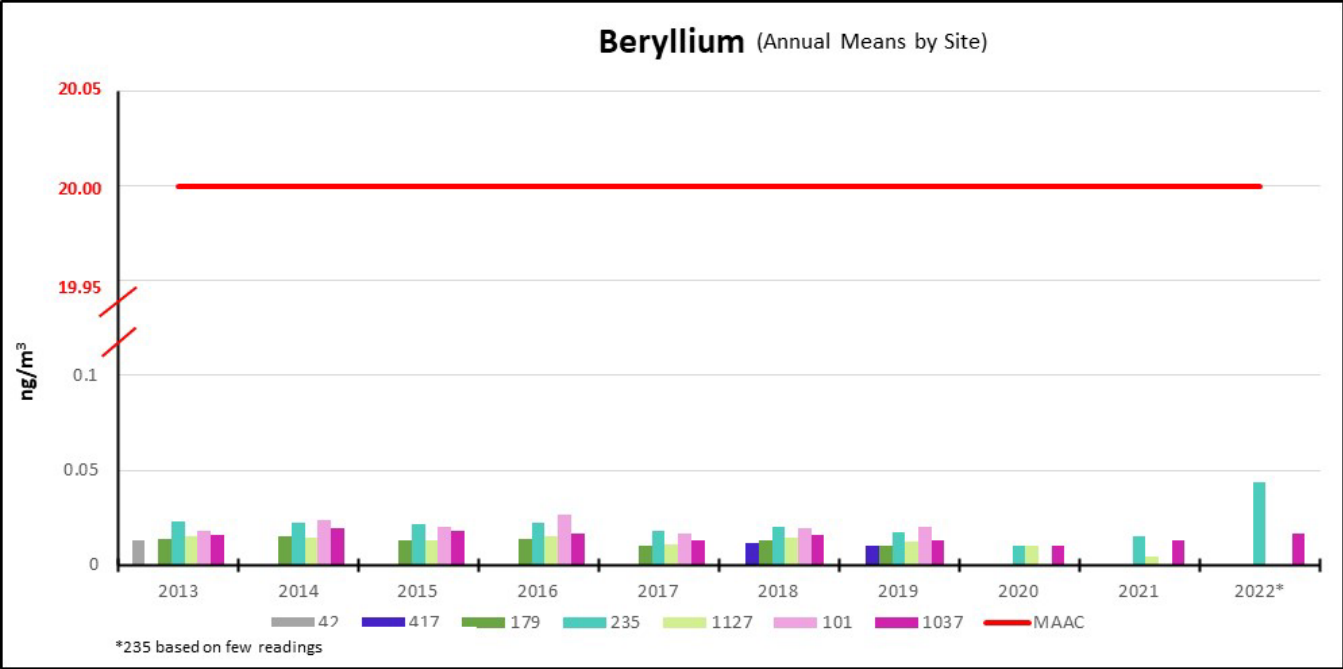
MAAC: 0.02 $\mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

The MAAC would be based on the IRIS 10^{-4} inhalation risk value (0.04 $\mu\text{g}/\text{m}^3$), but in 2005 the MAAC set by SC 41 was 0.02 $\mu\text{g}/\text{m}^3$. To avoid “back-sliding” the level was kept at the SC 41 MAAC of 0.02 $\mu\text{g}/\text{m}^3$ in Appendix O.

SOURCES: Many industrial, chemical, and manufacturing processes, and gasoline/coal combustion. The 2021 Air Quality Emission Inventory showed 0.027 tons reported. The AQD does not have an accurate emission inventory for beryllium from mobile sources.

HEALTH EFFECTS: Beryllium is listed as a probable human carcinogen (lung cancer) based on animal studies. Non-cancer health effects: Acute inhalation of high levels of beryllium can cause inflammation of the lungs in humans; these symptoms may be reversible after exposure ends. Long-term exposure may cause chronic beryllium disease (berylliosis), in which granulomatous lesions develop in the lung.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



1,3-BUTADIENE

CAS # 106-99-0

SYNONYMS: bivinyll, divinyll, erythrene, vinyl ethylene, biethylene, pyrrolylene

DESCRIPTION: formula C₄-H₆, mol. wt. = 54.09 Colorless, flammable gas with strong aromatic odor.

CARCINOGEN status (IRIS): KNOWN

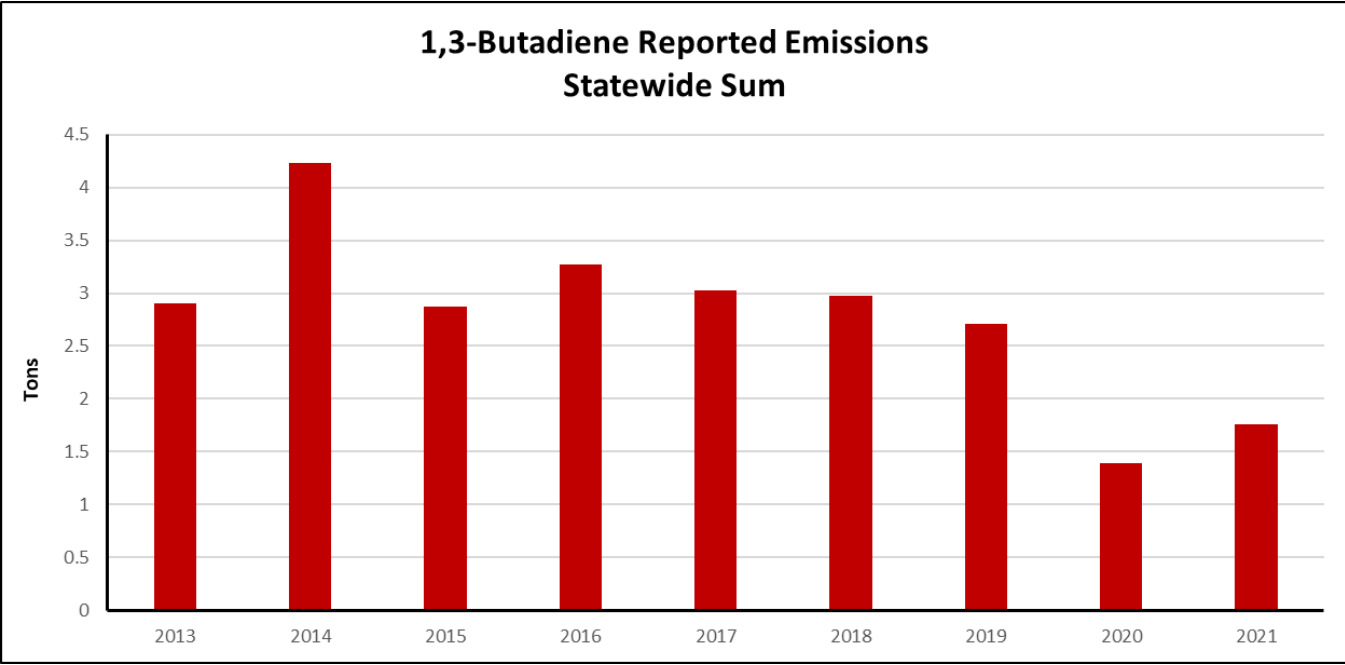
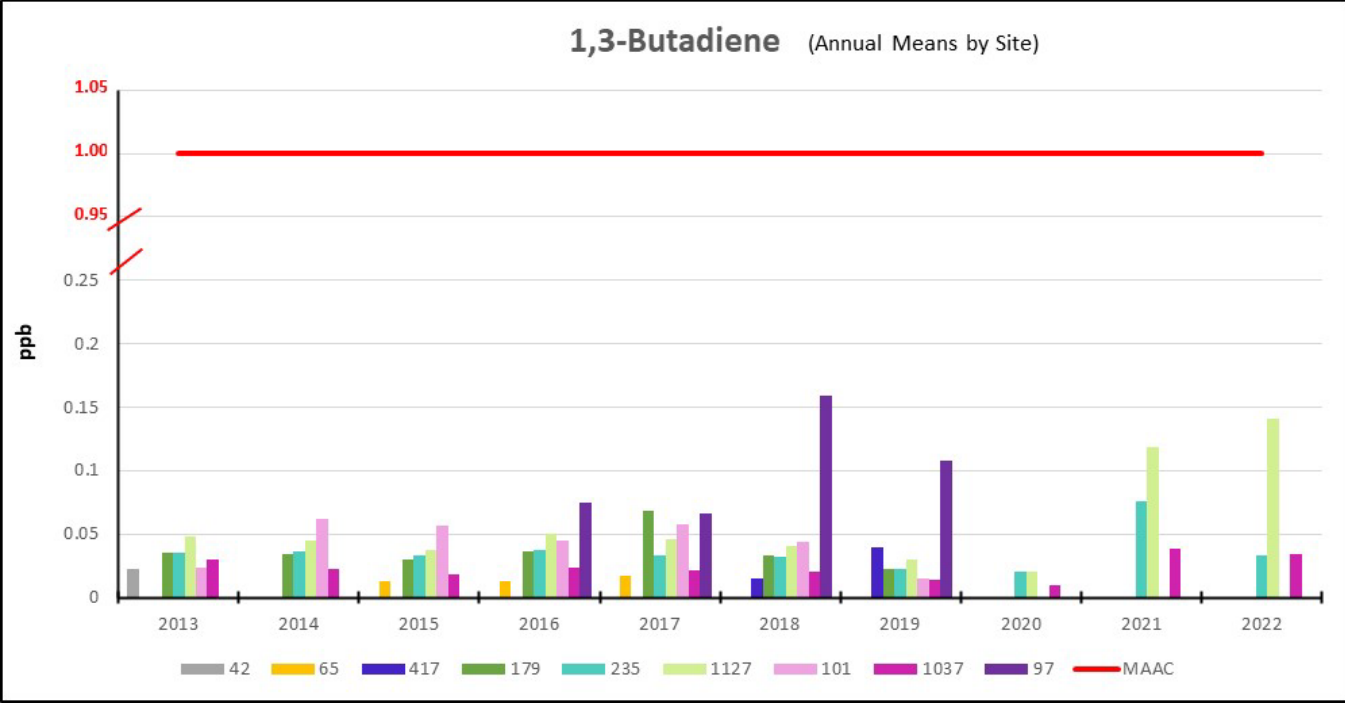
MAAC: 1 ppb (3 µg/m³) 24-hour average

MAAC is based on IRIS 10⁻⁴ inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes, but especially fuel combustion. The 2021 Air Quality Emission Inventory showed 1.762 tons reported. The AQD does not have an accurate emission inventory for 1,3-butadiene from mobile sources, but mobile source contributions are probably significant.

HEALTH EFFECTS: Well-documented carcinogen, especially leukemia and other lymphomas.

MONITORING METHOD: EPA TO-15.



CADMIUM Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula Cd-, there are many cadmium compounds.

CARCINOGEN status (IRIS): PROBABLE

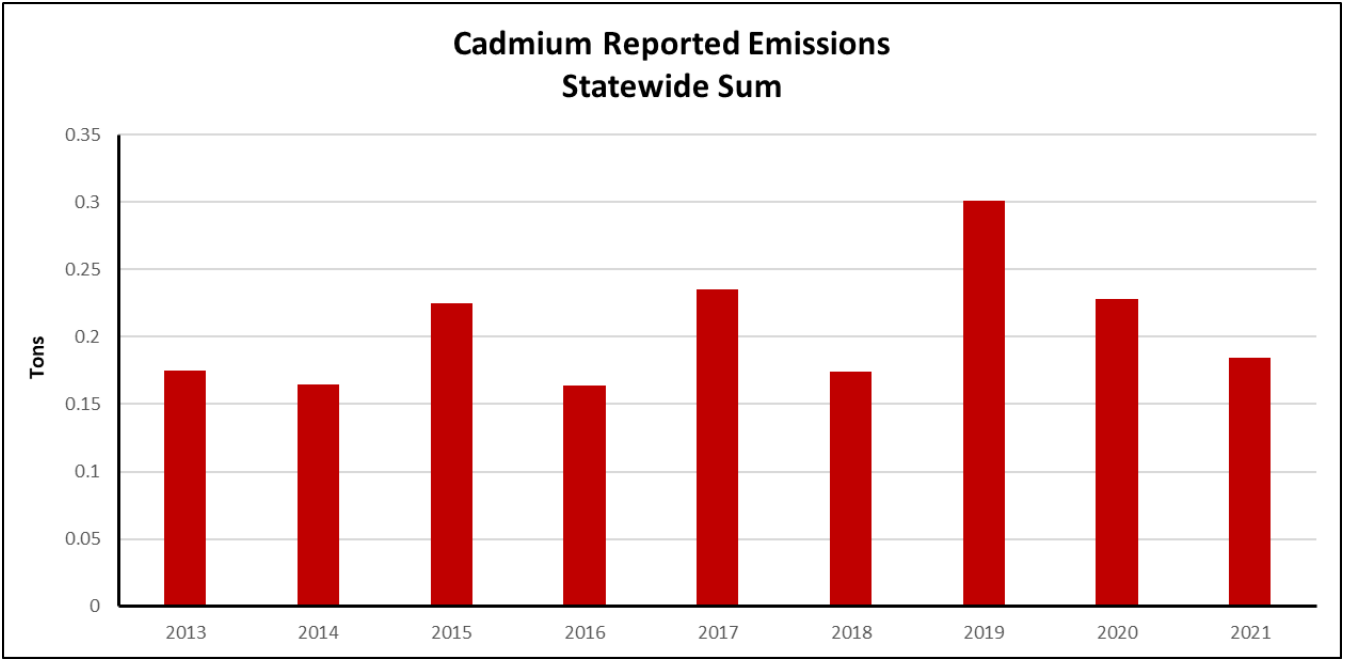
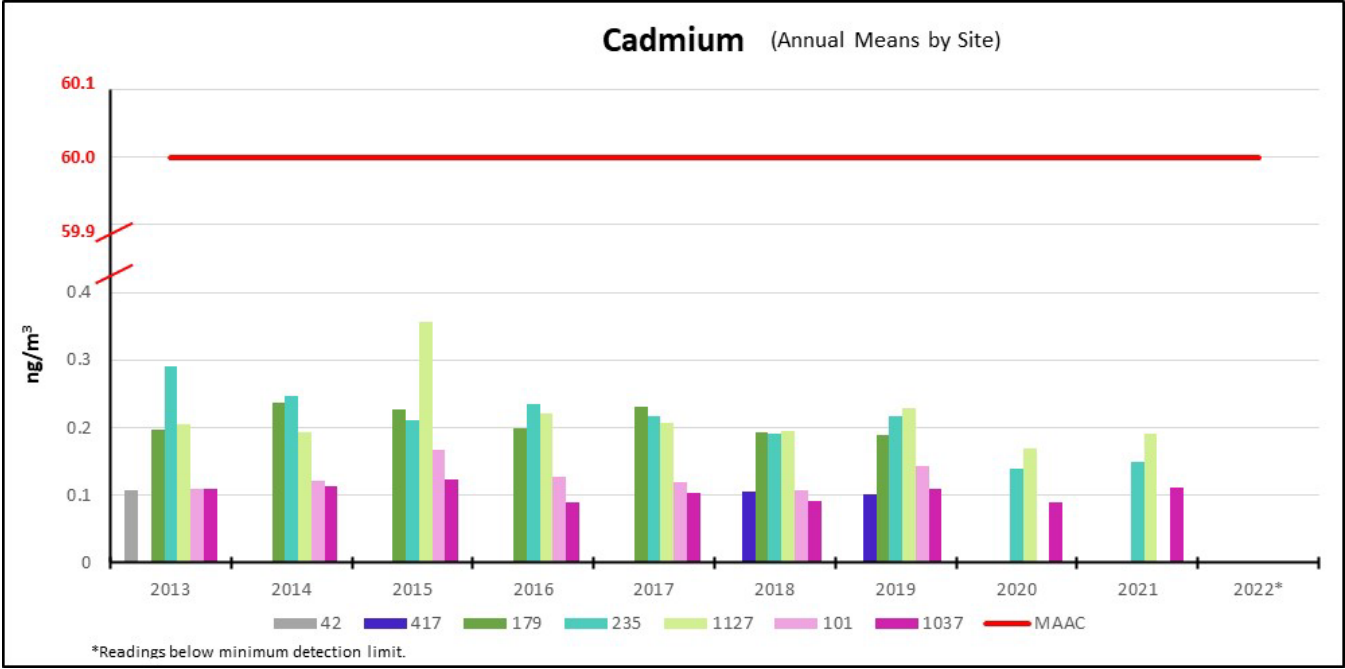
MAAC: 0.06 $\mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes and gasoline combustion. The 2021 Air Quality Emission Inventory showed 0.184 tons reported. The AQD does not have an accurate emission inventory for cadmium from mobile sources.

HEALTH EFFECTS: Listed as probable human carcinogen, especially respiratory cancers. Non-cancer effects: Subchronic and chronic exposures to cadmium have been associated with renal, cardiovascular, endocrine, hepatic, bone, hematological, and immunological effects. Respiratory conditions include bronchiolitis and emphysema.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



CARBON TETRACHLORIDE

CAS # 56-23-5

SYNONYMS: carbon chloride; carbon tet; methane tetrachloride; perchloromethane; tetrachlorocarbon; tetrachloromethane; Benzinoform; Univerm; Necatorina

DESCRIPTION: formula CCl_4 , mol. wt. = 153.24 Carbon tetrachloride is a nonflammable, colorless, clear, heavy liquid. It has a sweetish, aromatic, moderately strong ethereal odor resembling that of chloroform.

CARCINOGEN status (IRIS): PROBABLE

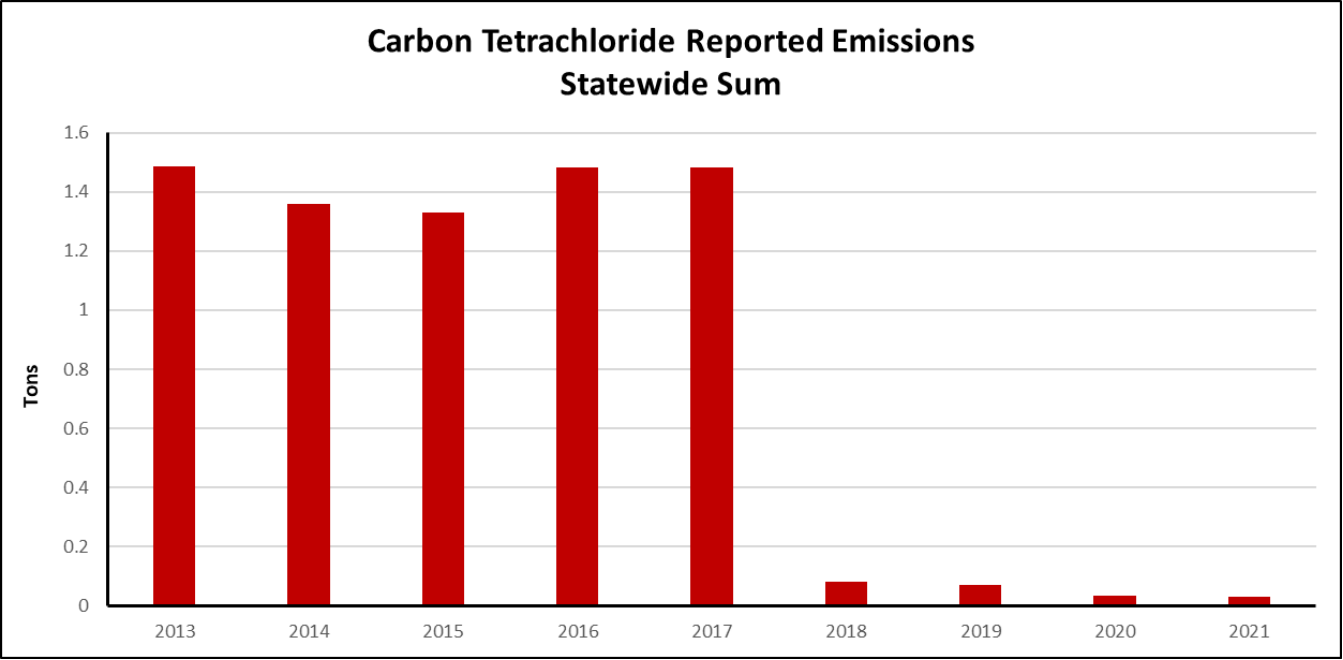
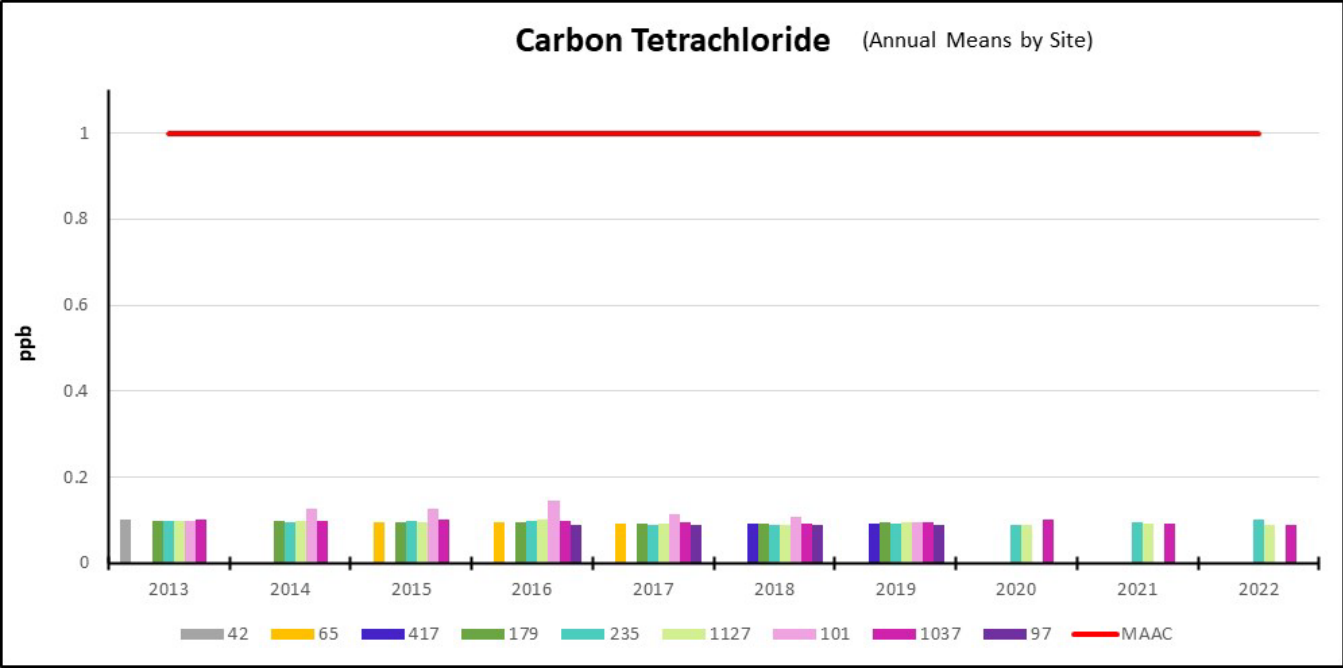
MAAC: 1 ppb ($7.0 \mu\text{g}/\text{m}^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Uses have declined drastically, but carbon tetrachloride is still emitted from chemical and refining processes. The 2021 Air Quality Emission Inventory showed 0.032 tons reported. Carbon tetrachloride is a “global” pollutant with a background concentration of about 0.010 ppb.

HEALTH EFFECTS: Probable carcinogen (liver cancer) based on some human but mainly animal testing. Non-cancer effects: Carbon tetrachloride is a central nervous system depressant and mild eye and respiratory tract irritant. It is highly hepato- and nephro- toxic.

MONITORING METHOD: EPA TO-15.



CHLOROFORM

CAS # 67-66-3

SYNONYMS: trichlormethane; methane trichloride; methenyl chloride; trichloroform; TCM; methyl trichloride; methenyl trichloride

DESCRIPTION: formula CHCl_3 , mol. wt. = 119.38 Chloroform is a clear colorless volatile liquid with an ethereal scent that is nonflammable and does not form explosive mixtures at atmospheric temperatures and pressures.

CARCINOGEN status (IRIS): PROBABLE

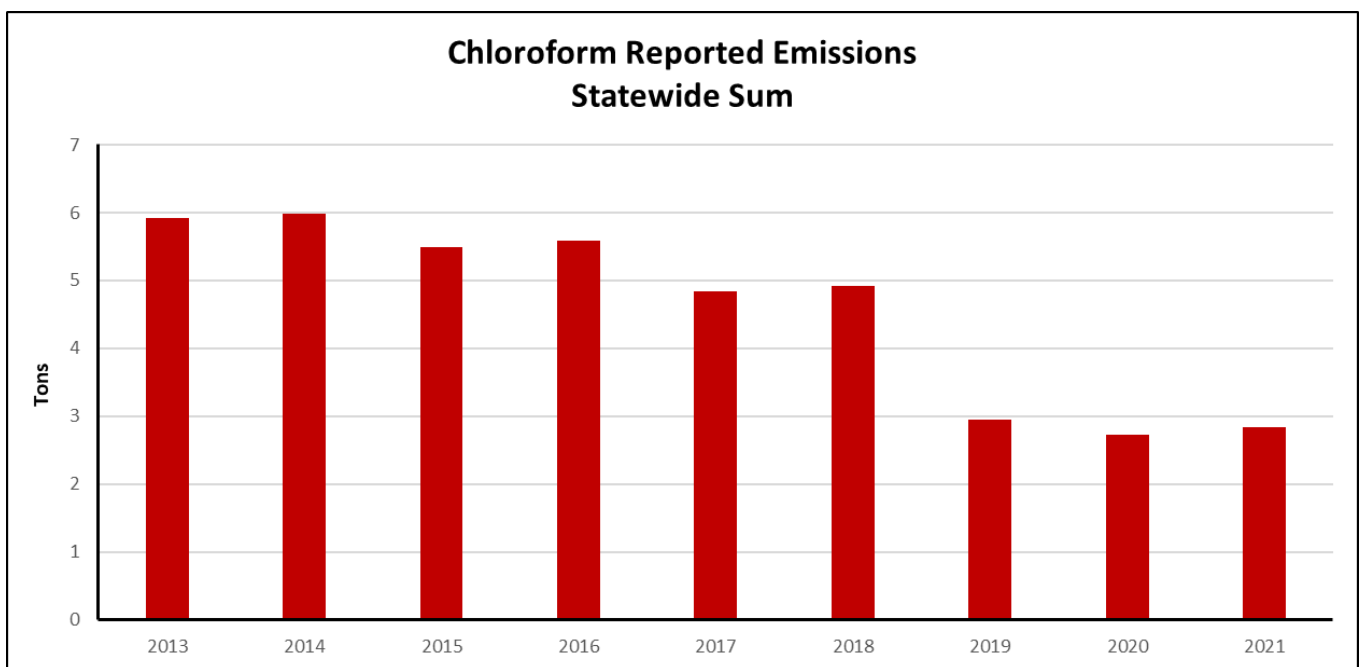
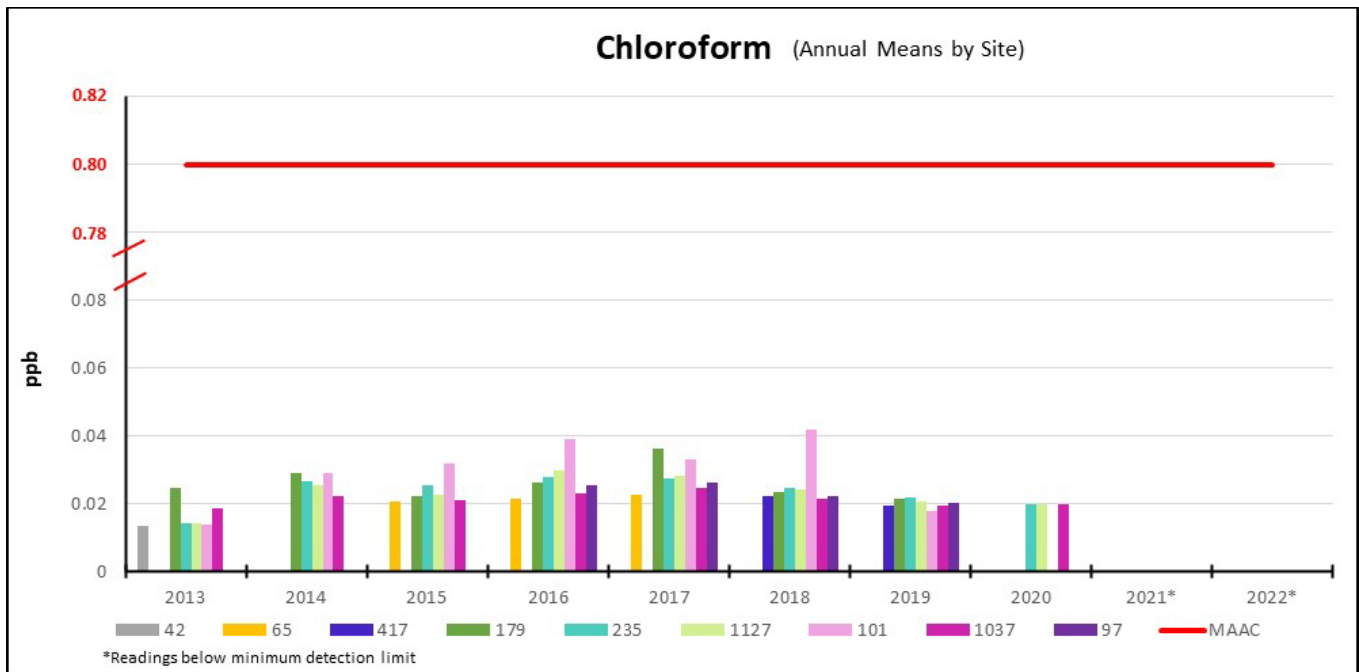
MAAC: 0.8 ppb ($4.0 \mu\text{g}/\text{m}^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes, especially pulp and paper. The 2021 Air Quality Emission Inventory showed 2.834 tons reported.

HEALTH EFFECTS: Chloroform has been shown to be carcinogenic in animals after oral exposures resulting in kidney and liver tumors. Non-Cancer effects: The vapors are irritating to the eyes and respiratory tract. Chloroform is a central nervous system depressant. At high levels it can also produce cardiac arrhythmias by sensitization to adrenaline. Chronic inhalation exposure to chloroform can damage the liver.

MONITORING METHOD: EPA TO-15.



CHROMIUM Compounds (HEXAVALENT)

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula Cr^{+6} , a very large group of compounds.

CARCINOGEN status (IRIS): KNOWN

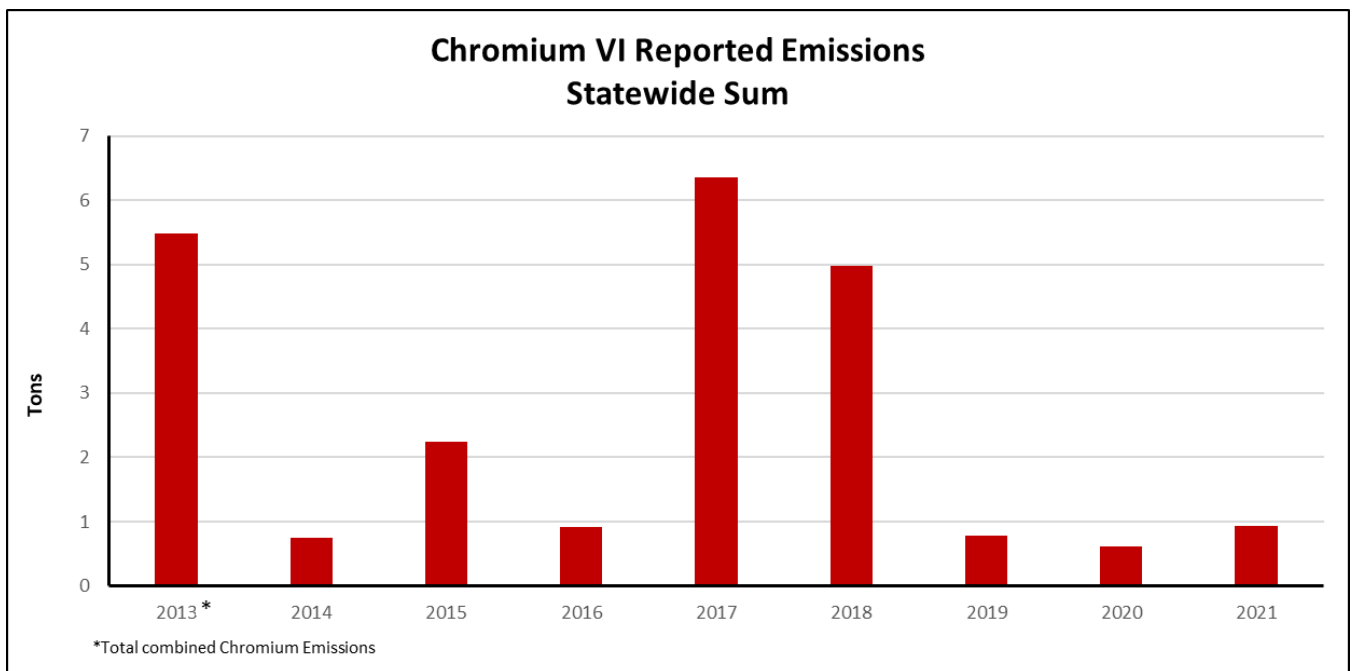
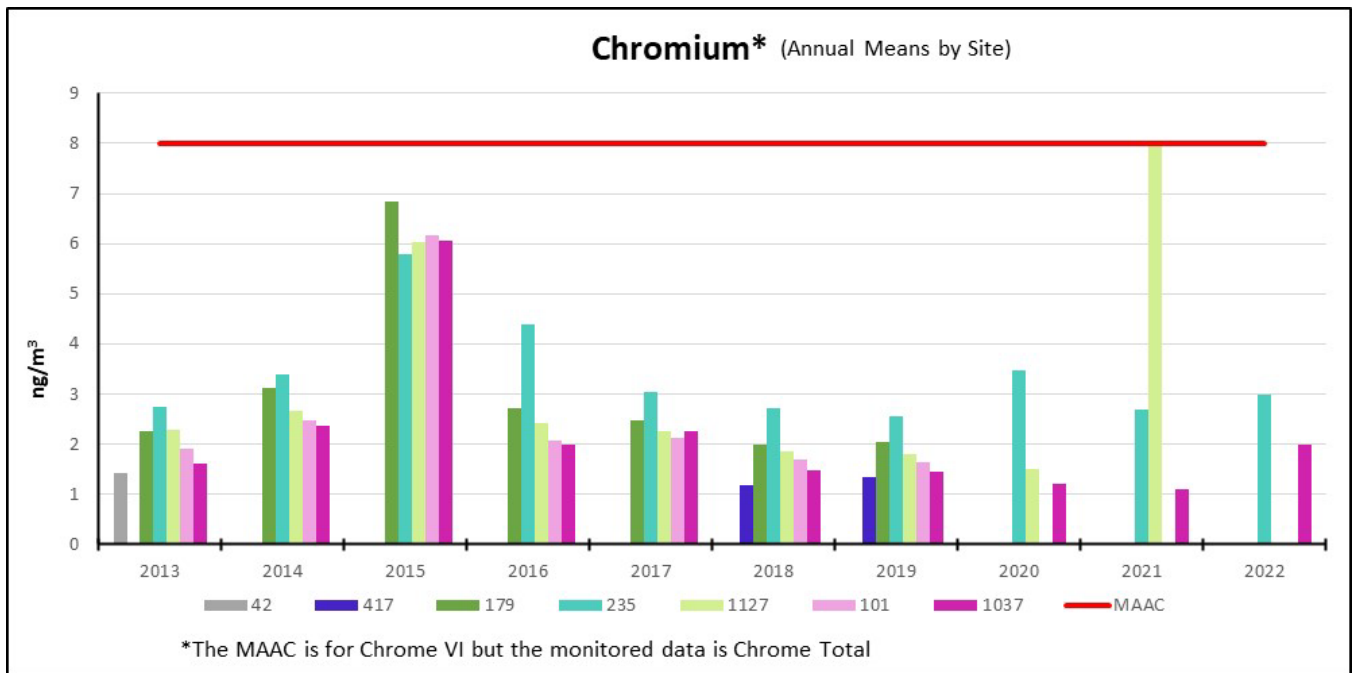
MAAC: $0.008 \mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes, especially plating and anodizing. The 2021 Air Quality Emission Inventory showed 0.929 tons of chromium VI reported.

HEALTH EFFECTS: Well-documented carcinogen, lung cancer.

MONITORING METHOD: Modified CARB Method for hexavalent chromium compounds.



ETHYLBENZENE

CAS # 100-41-4

SYNONYMS: phenylethane

DESCRIPTION: formula C_8H_{10} , mol. wt. = 106.16 Colorless, flammable liquid with strong aromatic odor.

CARCINOGEN status (IRIS): Not Classifiable

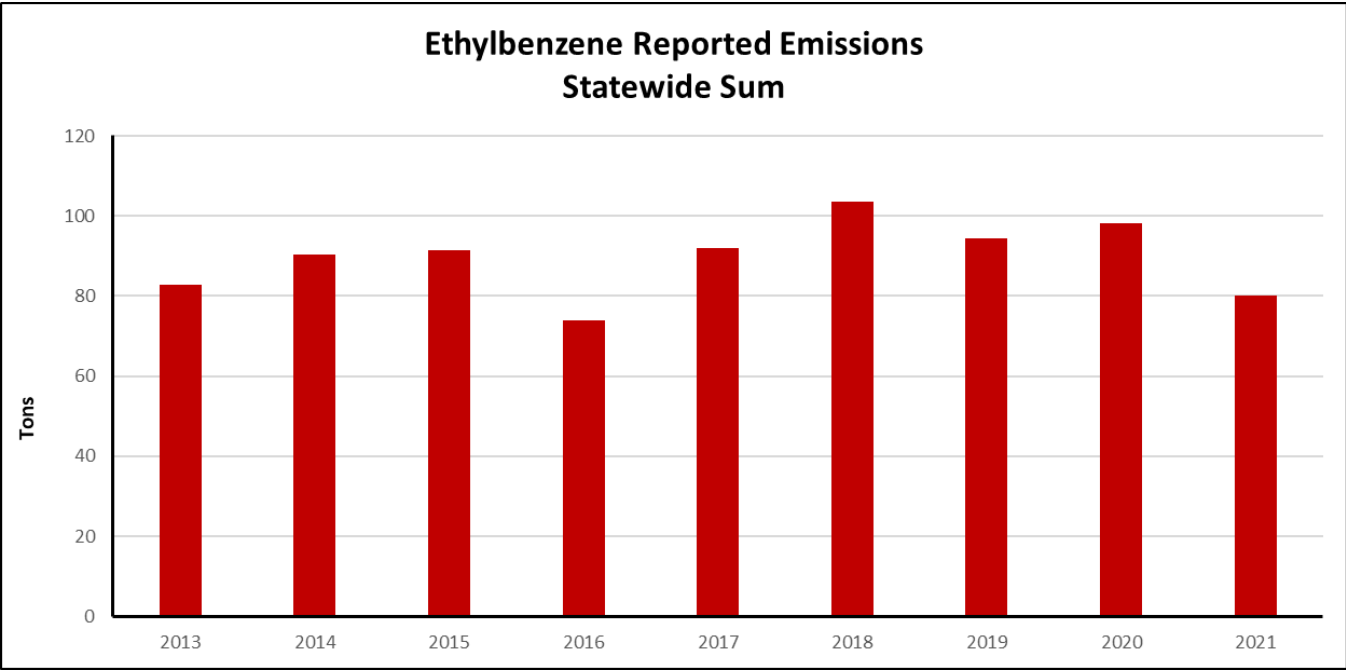
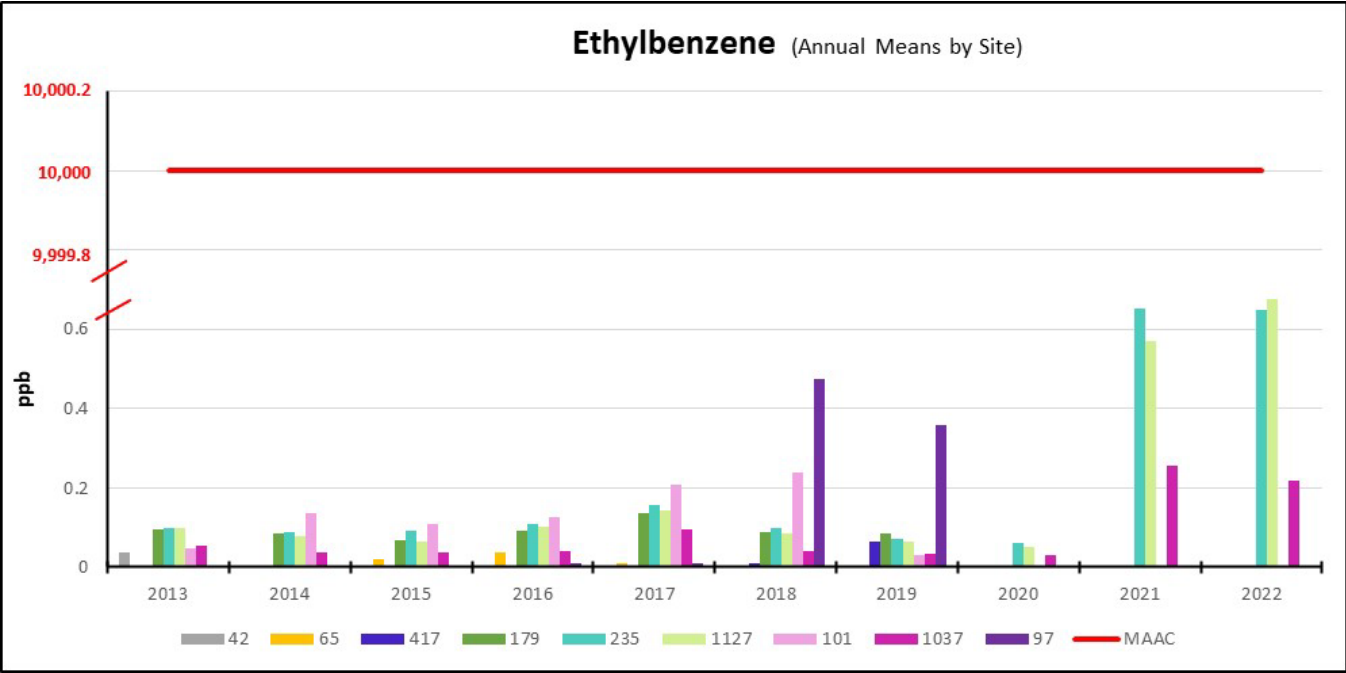
MAAC: 10, 000 ppb or 10 ppm ($43,427 \mu g/m^3$) 24-hour average

MAAC would be based on the No-Observed Adverse Effect Level (NOAEL) Human Equivalent Concentration (HEC) (100 ppm) but in 2005 the MAAC set by SC 41 was 10 ppm. To avoid "back-sliding" the level was kept at the SC 41 MAAC of 10 ppm in Appendix O.

SOURCES: Many industrial, chemical, and manufacturing processes, especially in styrene production and as a solvent, and gasoline combustion. The 2021 Air Quality Emission Inventory showed 80.126 tons reported. The AQD does not have an accurate emission inventory for ethylbenzene from mobile sources.

HEALTH EFFECTS: Ethylbenzene is a central nervous system depressant at high levels of exposure. Ethylbenzene is also irritating to the eyes and respiratory tract. Animal studies have shown effects on the blood, liver and kidneys from chronic inhalation exposure to ethylbenzene.

MONITORING METHOD: EPA TO-15.



ETHYLENE DICHLORIDE

CAS # 107-06-2

SYNONYMS: **1,2-dichloroethane**; sym-dichloroethane; ethylene chloride; EDC; Dutch liquid; Brocide; 1,2-ethylene dichloride; ethane dichloride; Freon 150; Di-chlor-mulsion; glycol dichloride

DESCRIPTION: formula $C_2H_4Cl_2$, mol. wt. = 98.96 Ethylene dichloride is a heavy, oily, liquid which burns with a smoky flame. Usually it is colorless but it will darken in the presence of air, moisture, and light. It has a chloroform-like odor and irritating vapors.

CARCINOGEN status (IRIS): PROBABLE

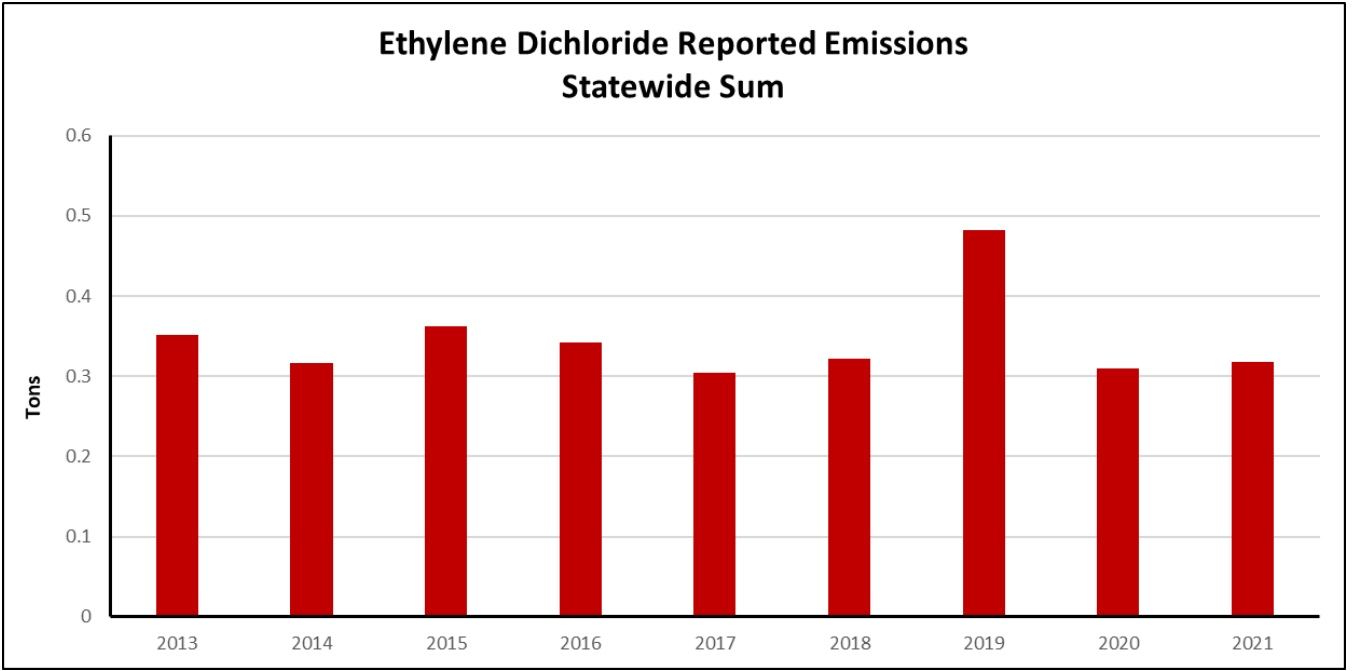
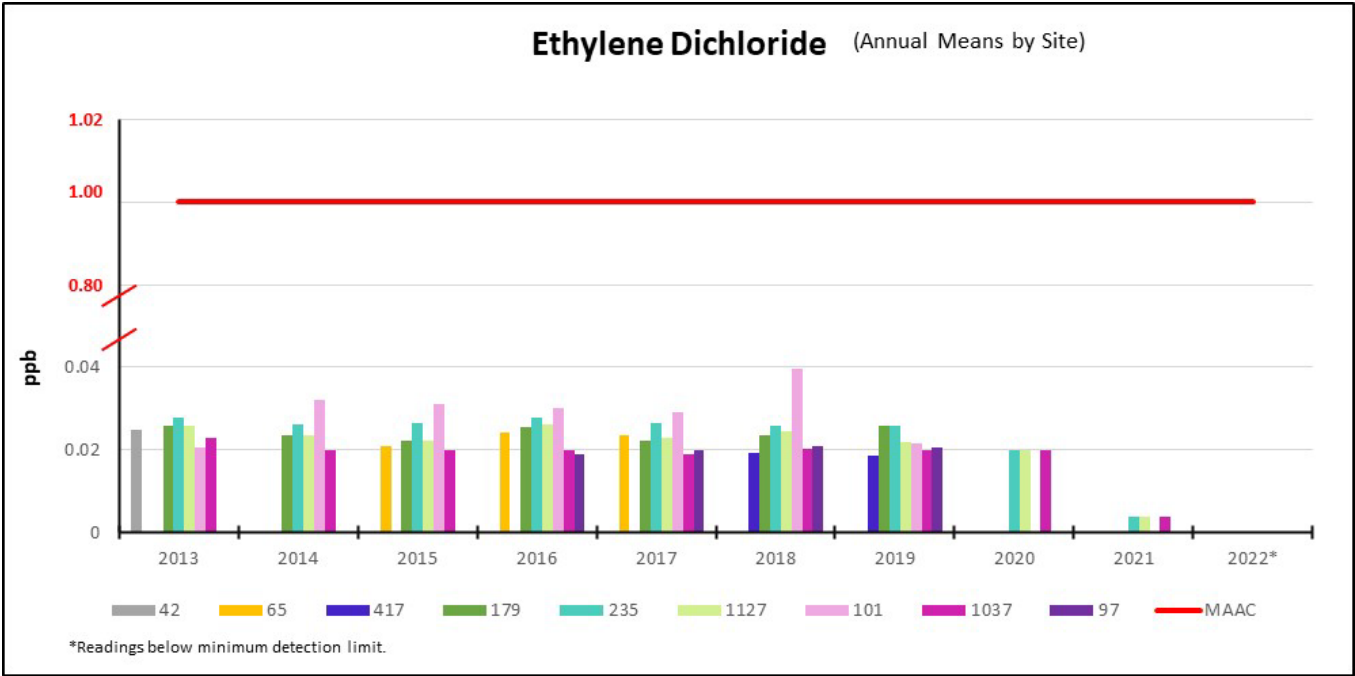
MAAC: 1 ppb ($4 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes, previously in leaded gasoline combustion. The 2021 Air Quality Emission Inventory showed 0.318 tons reported.

HEALTH EFFECTS: Probable carcinogen (colon and renal) based on animal studies and limited epidemiological information. Vapors are irritating to eyes and respiratory tract. Ethylene dichloride is highly nephrotoxic and hepatotoxic and a central nervous system (CNS) depressant at high levels.

MONITORING METHOD: EPA TO-15.



FORMALDEHYDE

CAS # 50-00-0

SYNONYMS: methanal; formic aldehyde; oxomethane; oxymethylene; methylene oxide; methyl aldehyde; formalin; formic aldehyde; formal; morbici

DESCRIPTION: formula CH_2O , mol. wt. = 30.03. A colorless gas at room temperature with pungent odor.

CARCINOGEN status (IRIS): PROBABLE

Note: The International Agency for Research on Cancer (IARC) classifies formaldehyde as a known carcinogen

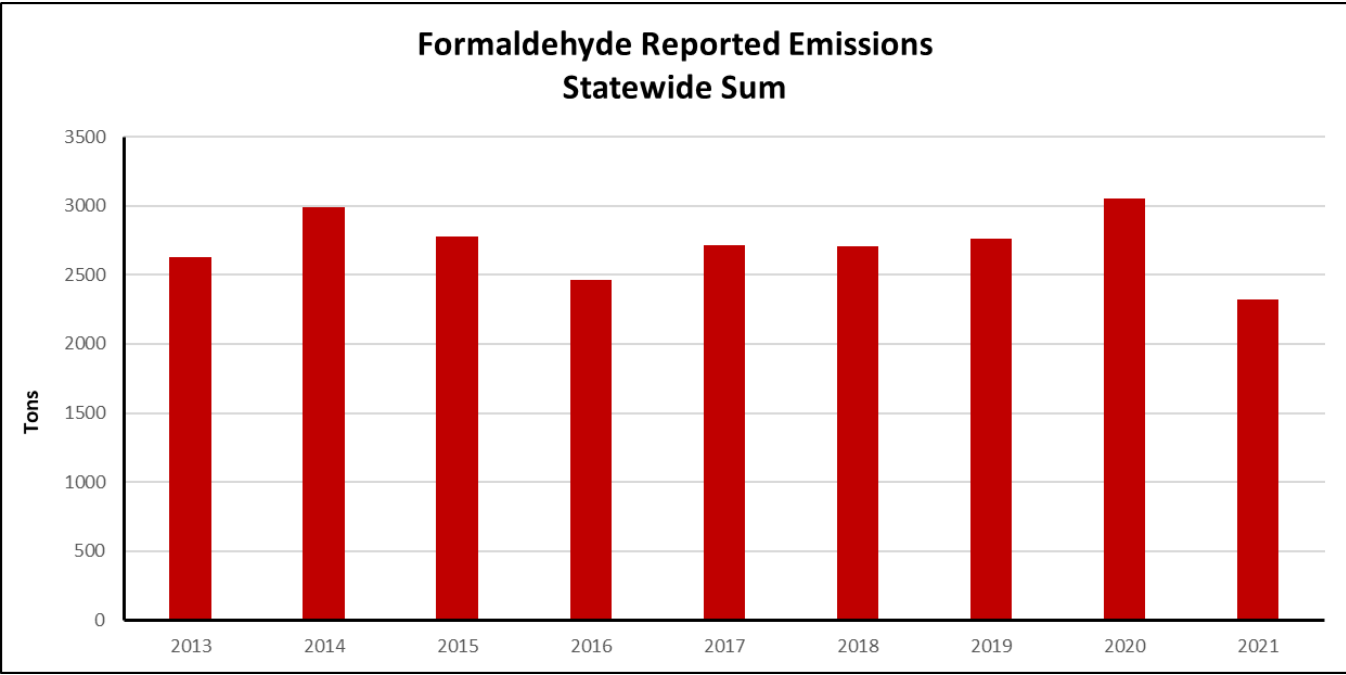
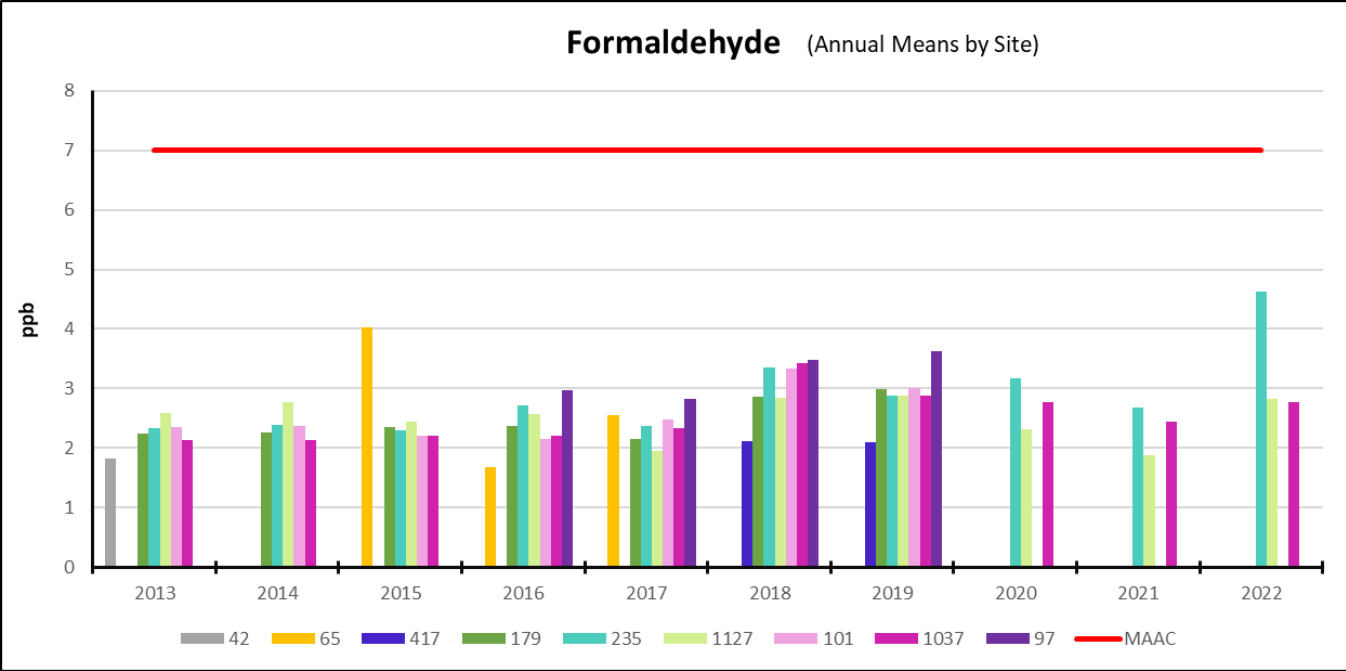
MAAC: 7 ppb ($8 \mu\text{g}/\text{m}^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Many industrial, chemical, and manufacturing processes and any fuel combustion sources; it is also formed by photochemical processes. The 2021 Air Quality Emission Inventory showed 2323.891 tons reported. The AQD does not have an accurate emission inventory for formaldehyde from mobile sources.

HEALTH EFFECTS: Probable human carcinogen based on limited human and animal testing, for lung and nasopharyngeal cancer. Non-Cancer effects: Vapors are highly irritating to the eye and respiratory track. Acute effects include nausea, headaches, and difficulty breathing. Formaldehyde can also induce or exacerbate asthma.

MONITORING METHOD: EPA TO-11A.



MANGANESE Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula Mn-. There are many compounds of manganese

CARCINOGEN status (IRIS): Not Classifiable

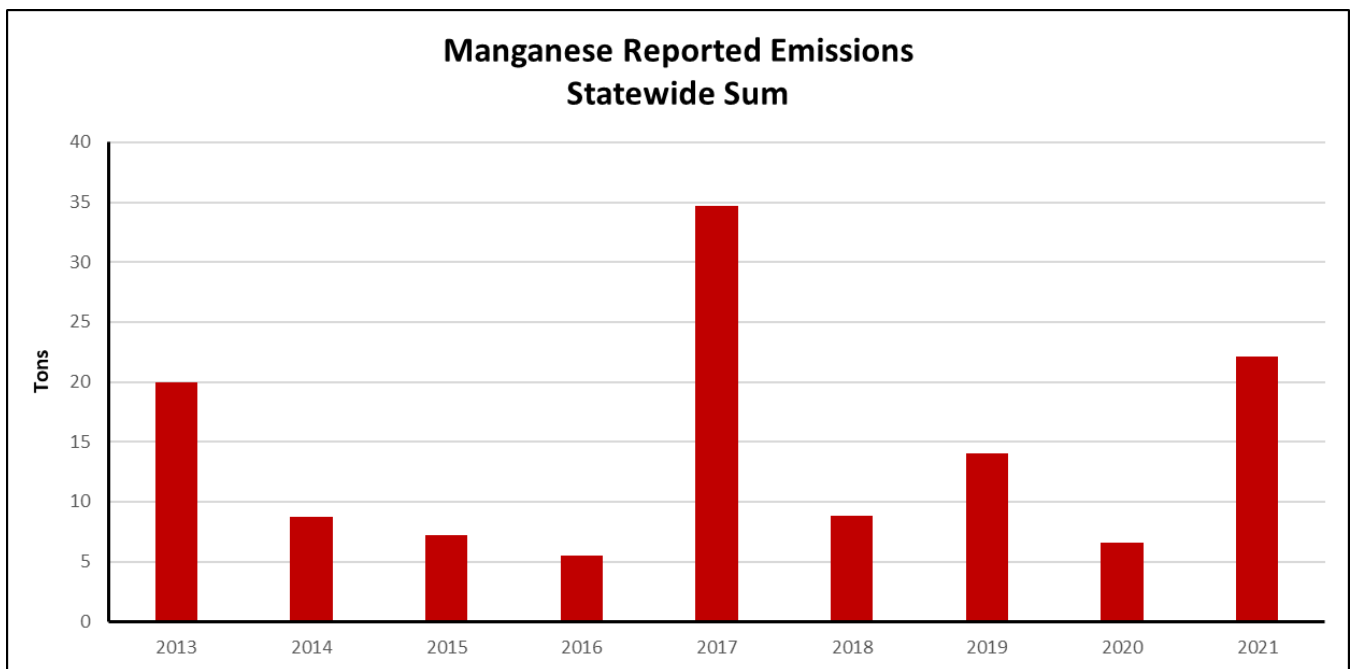
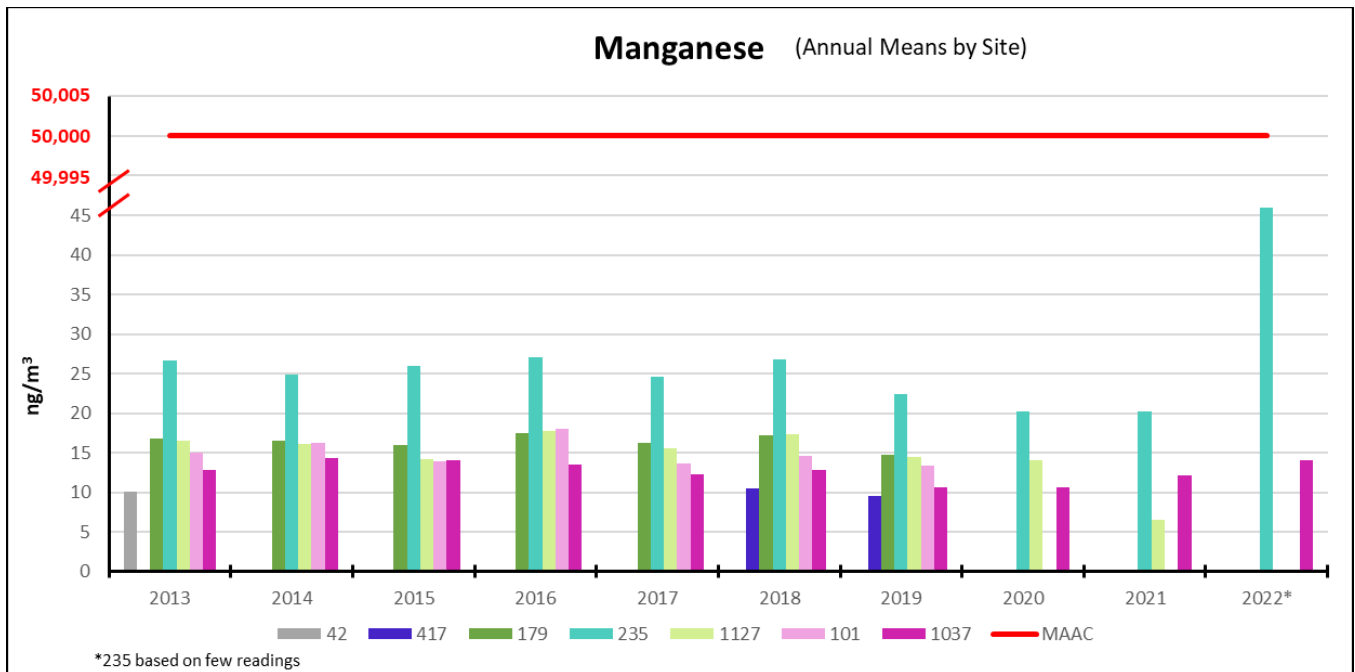
MAAC: 50 $\mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

MAAC is based on the IRIS inhalation Lowest Observed Adverse Effect Level (LOAEL) Human Equivalent Concentration (HEC).

SOURCES: Many industrial processes, rock crushing, electric services, and petroleum refining. The 2021 Air Quality Emission Inventory showed 22.136 tons reported.

HEALTH EFFECTS: Affects respiratory, central, and peripheral nervous systems.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



MERCURY Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula Hg-, several compounds exist.

CARCINOGEN status (IRIS): Not Classifiable

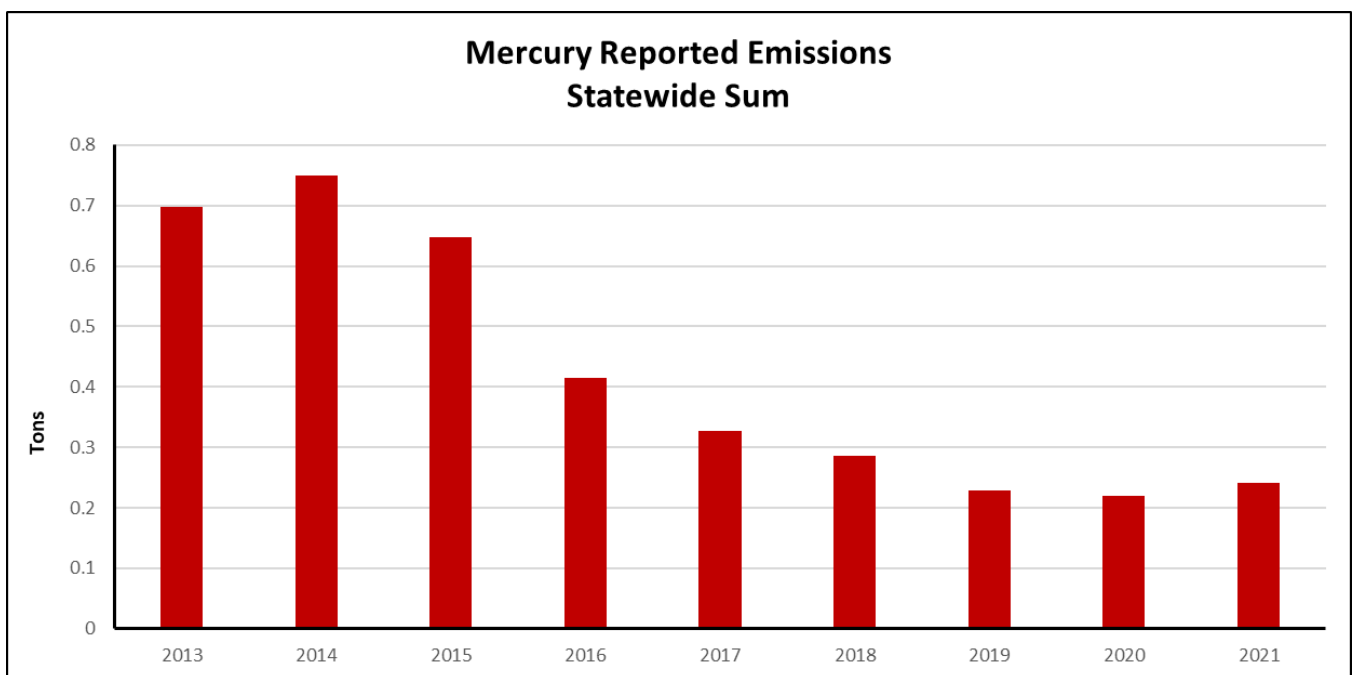
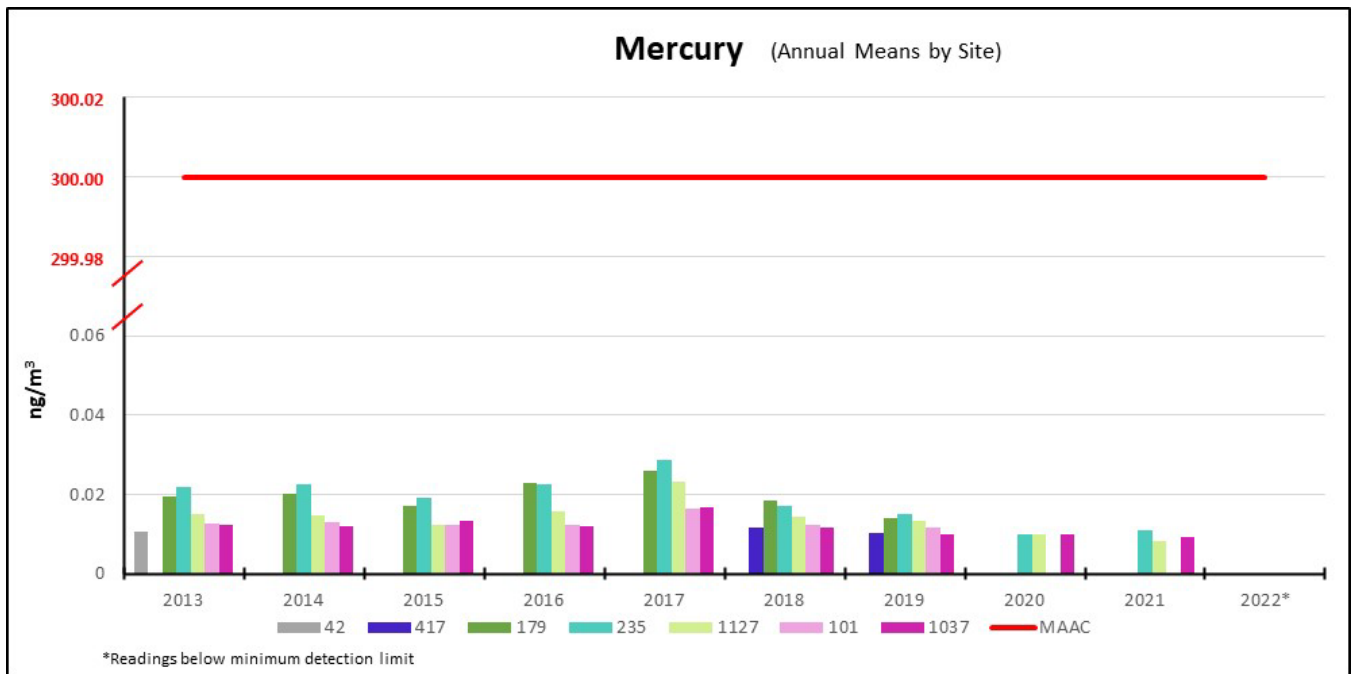
MAAC: 0.3 $\mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

MAAC is based on the IRIS Inhalation Reference Concentration (RfC) value.

SOURCES: Used in the manufacture of dry cell batteries, fluorescent light bulbs, agricultural pesticides, antifouling paint, electrical apparatus, electrolytic preparation of chlorine and caustic soda, as a catalyst in the oxidation of organic compounds, electrical services, hydraulic cement manufacturing, and petroleum production. Mercury is also a globally transported pollutant. The 2021 Air Quality Emission Inventory showed 0.241 tons reported.

HEALTH EFFECTS: Increased incidence of tumors in rats and mice. Very well-documented toxin to renal and especially central nervous systems.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



METHYLENE CHLORIDE

CAS # 75-09-2

SYNONYMS: dichloromethane; methylene dichloride; Freon 30; Aerothene NM; Solmethine; methylene bichloride

DESCRIPTION: formula CH_2Cl_2 , mol. wt. = 84.94. Volatile, nonflammable, colorless, liquid with a sweetish smell.

CARCINOGEN status (IRIS): PROBABLE

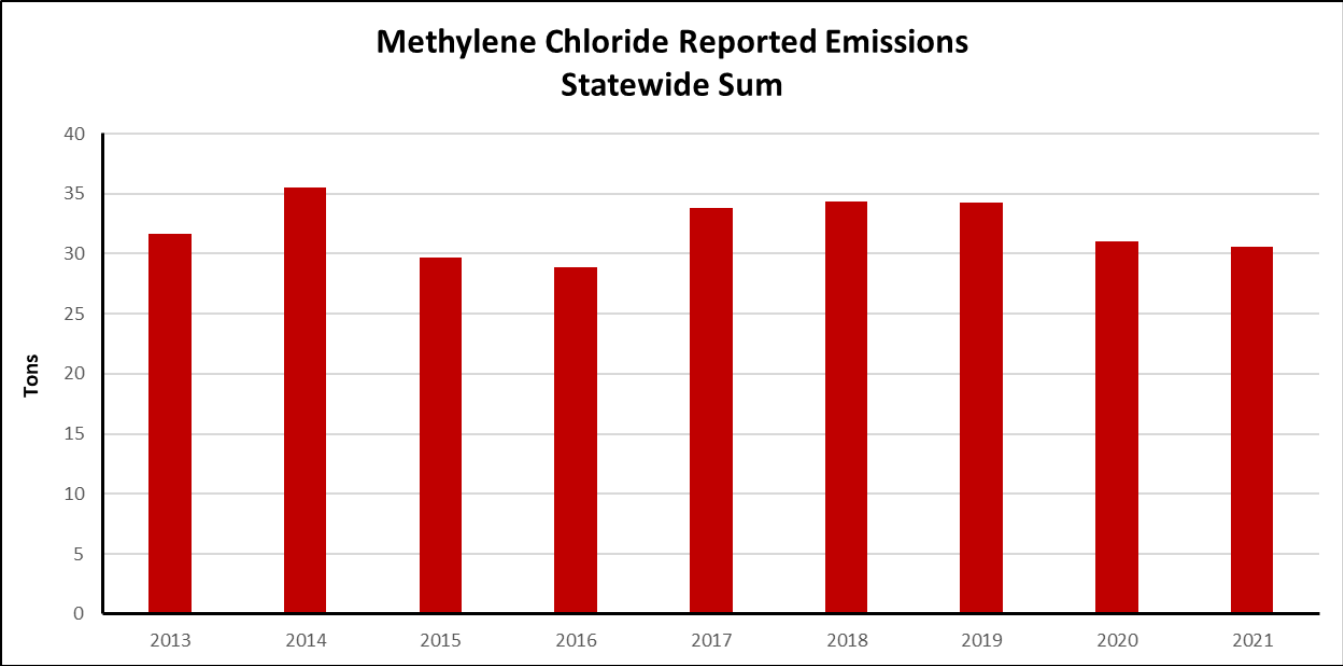
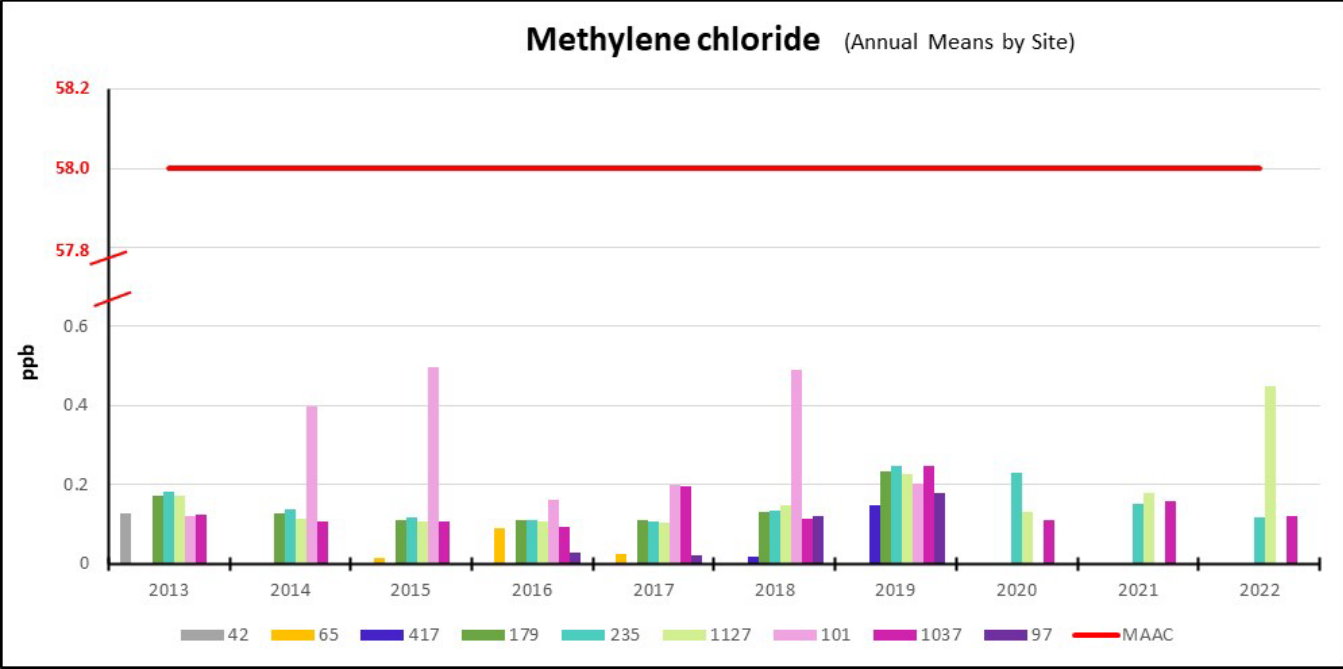
MAAC: 58 ppb, (200 $\mu\text{g}/\text{m}^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Used as a solvent, a blowing and cleaning agent in the manufacture of polyurethane foam and plastic fabrication, and in paint stripping operations. Other sources of emissions are landfills and wastewater treatment. The 2021 Air Quality Emission Inventory showed 30.552 tons reported. The AQD does not have an accurate emission inventory for methylene chloride from mobile sources.

HEALTH EFFECTS: Liver and lung tumors in animals. Non-Cancer effects: Methylene chloride vapor is irritating to the eyes, respiratory tract, and skin. It is also a central nervous system depressant including decreased visual and auditory functions and may cause headache, nausea, and vomiting.

MONITORING METHOD: EPA TO-15.



NICKEL Compounds

CAS # NOT APPLICABLE - Group

SYNONYMS: no common synonyms

DESCRIPTION: formula Ni-, many compounds of nickel

CARCINOGEN status (IRIS): PROBABLE (Note that while certain nickel compounds are known carcinogens, the overall group of nickel compounds is classified as a probable carcinogen.)

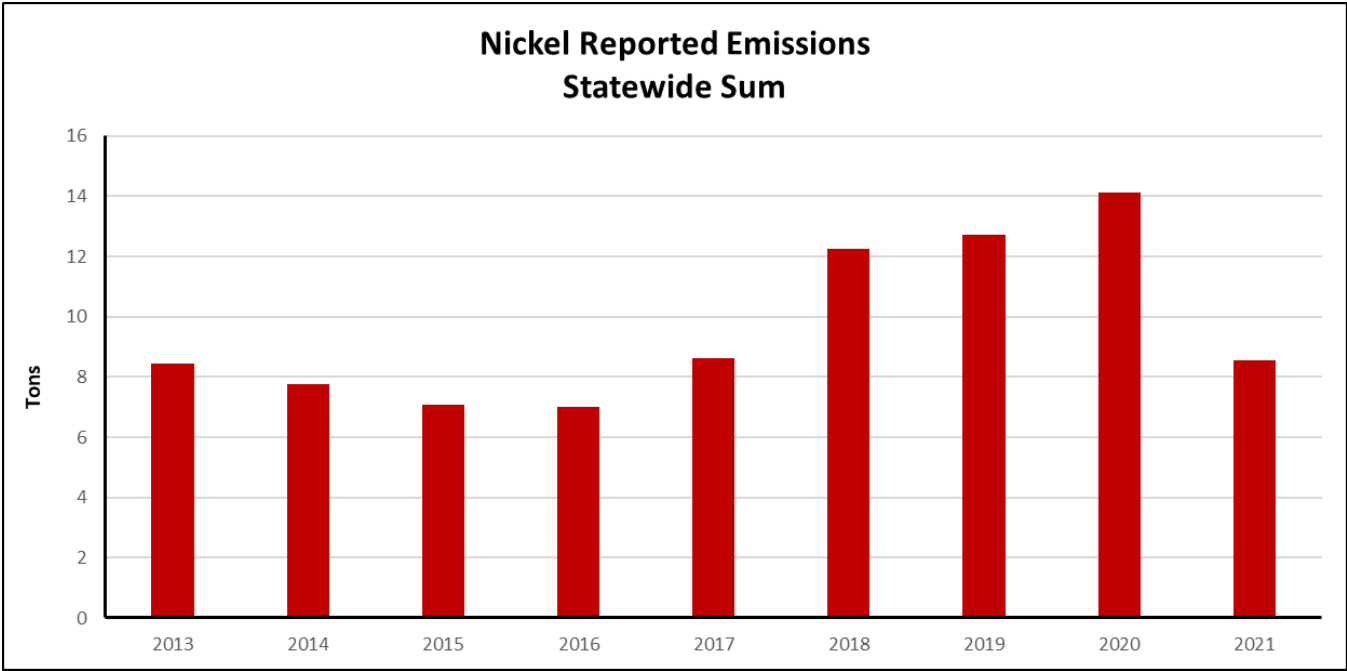
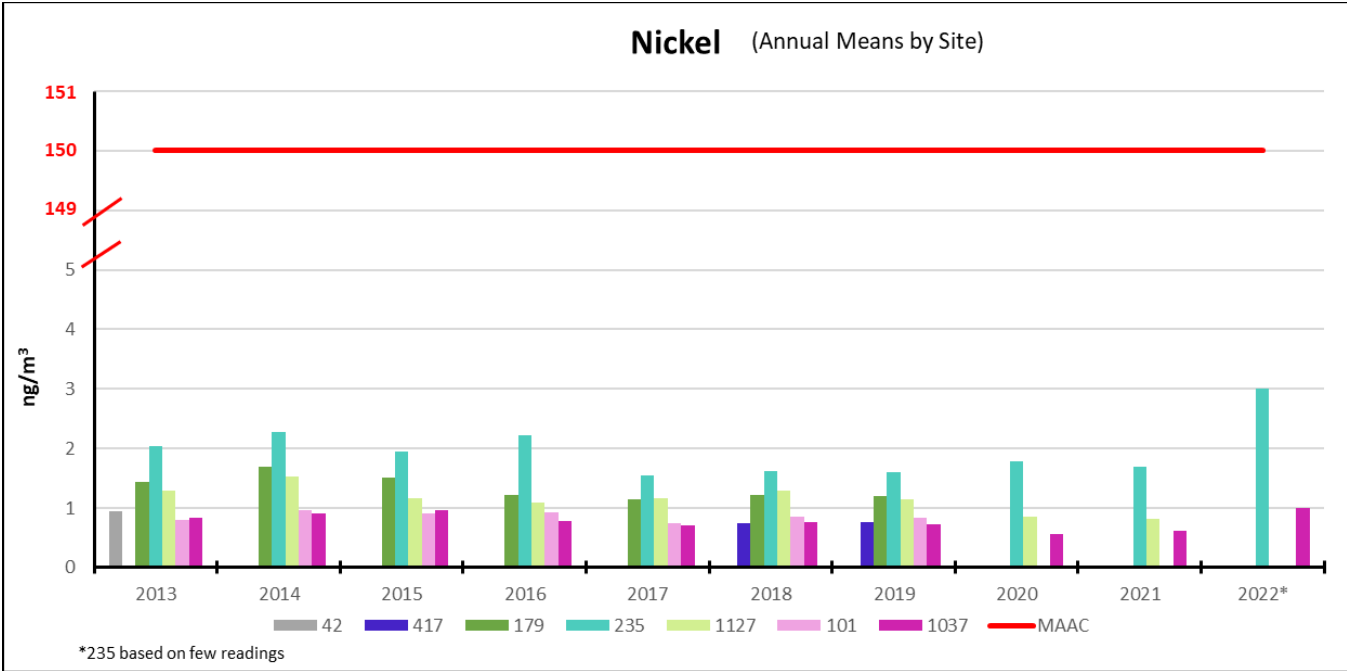
MAAC: $0.15 \mu\text{g}/\text{m}^3$ 24-hour average (no equivalent ppm value because the MAAC is for a group of compounds)

The MAAC would be based on IRIS 10^{-4} inhalation risk value ($0.4 \mu\text{g}/\text{m}^3$), but in 2005 the MAAC set by SC 41 was $0.15 \mu\text{g}/\text{m}^3$. To avoid “back-sliding” the level was kept at the SC 41 MAAC of $0.15 \mu\text{g}/\text{m}^3$ in Appendix O.

SOURCES: Used for the production of various metal alloys, cast irons, and electroplated goods and as a catalyst in the petroleum, plastic, and rubber industries. The 2021 Air Quality Emission Inventory showed 8.548 tons reported. The AQD does not have an accurate emission inventory for nickel compounds from mobile sources.

HEALTH EFFECTS: Inhalation exposure to nickel refinery dust and nickel subsulfide has been shown to cause nasal and lung cancer. Non-Cancer effects: The effects from long-term exposure to nickel include respiratory tract irritation and immune alterations such as dermatitis (“nickel itch”) and asthma.

MONITORING METHODS: EPA IO-2 Hi-Vol and EPA IO-3.5 ICP/MS.



TOLUENE

CAS # 108-88-3

SYNONYMS: methacide; methylbenzene; methylbenzol; phenylmethane; toluol

DESCRIPTION: formula C₇-H₈, mol. wt. = 92.13. Colorless, flammable, non-corrosive liquid.

CARCINOGEN status (IRIS): Not Assessed

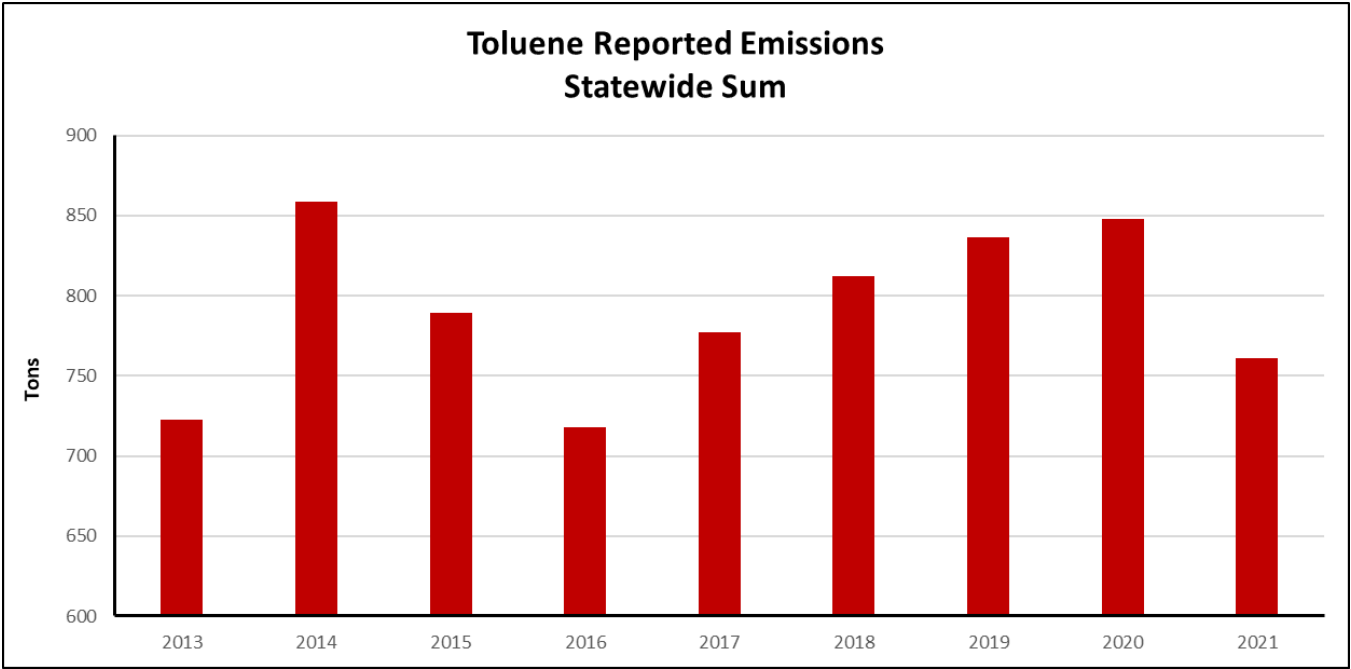
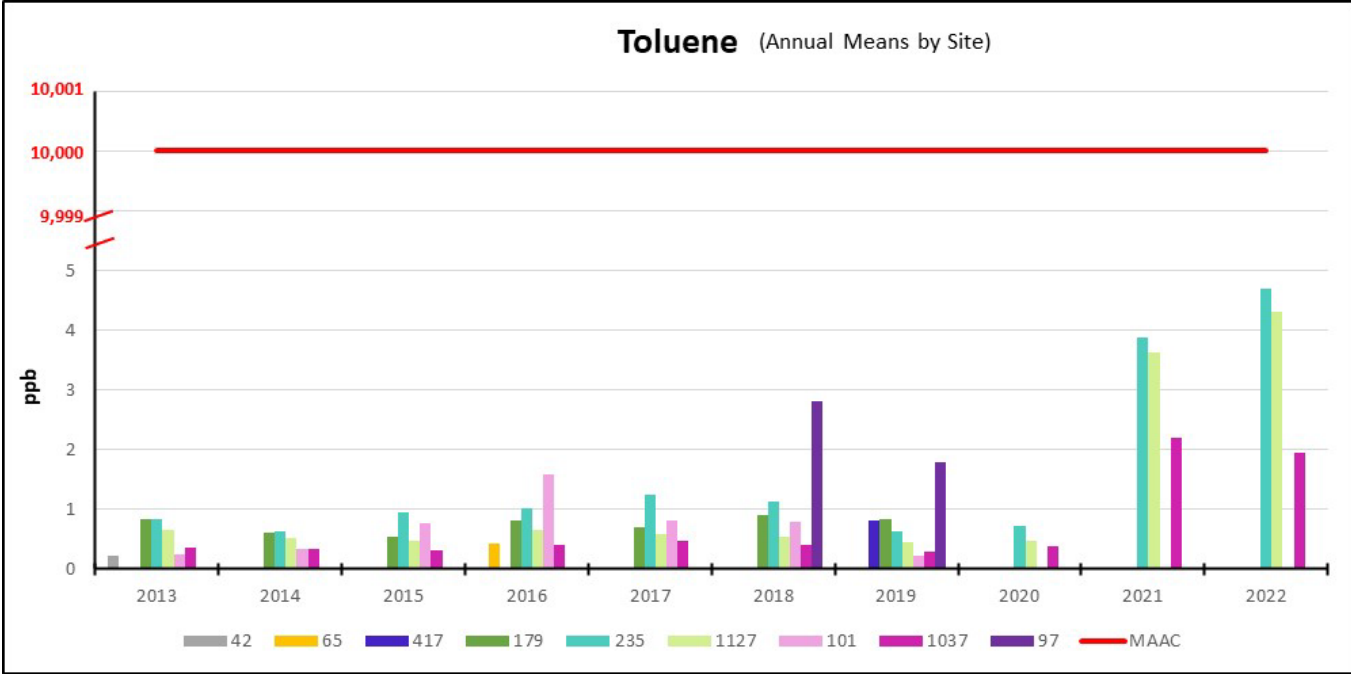
MAAC: 10,000 ppb or 10 ppm (37,668 µg/m³) 24-hour average

MAAC would be based on the IRIS inhalation Lowest Observed Adverse Effect Level (LOAEL) Human Equivalent Concentration (HEC) (32 ppm), but in 2005 the MAAC set by SC 41 was 10 ppm. To avoid "back-sliding" the level was kept at the SC 41 MAAC of 10 in Appendix O.

SOURCES: Used in aviation gasoline and high-octane blending stock, and as a solvent for paints, coatings, gums and resins. Other sources include petroleum production, used as a chemical intermediate, and for styrene production. The 2021 Air Quality Emission Inventory showed 761.240 tons reported. The AQD does not have an accurate emission inventory for toluene from mobile sources.

HEALTH EFFECTS: Acute and chronic exposures depress the Central Nervous System. May cause kidney and liver injury.

MONITORING METHOD: EPA TO-15.



1,1,2,2-TETRACHLOROETHANE

CAS # 79-34-5

SYNONYMS: tetrachloroethane; sym-tetrachloroethane; acetylene tetrachloride; Cellon; Bonoform

DESCRIPTION: formula $C_2H_2Cl_4$, mol. wt. = 167.86. Nonflammable, heavy liquid

CARCINOGEN status (IRIS): Probable

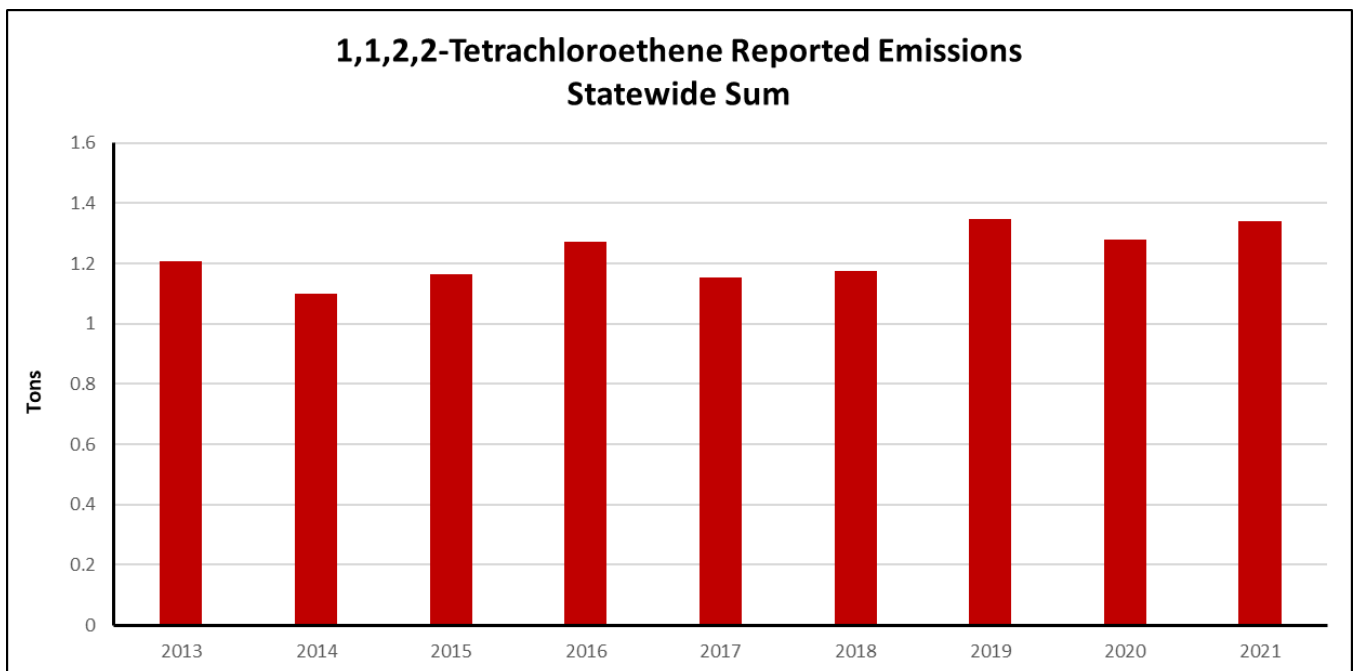
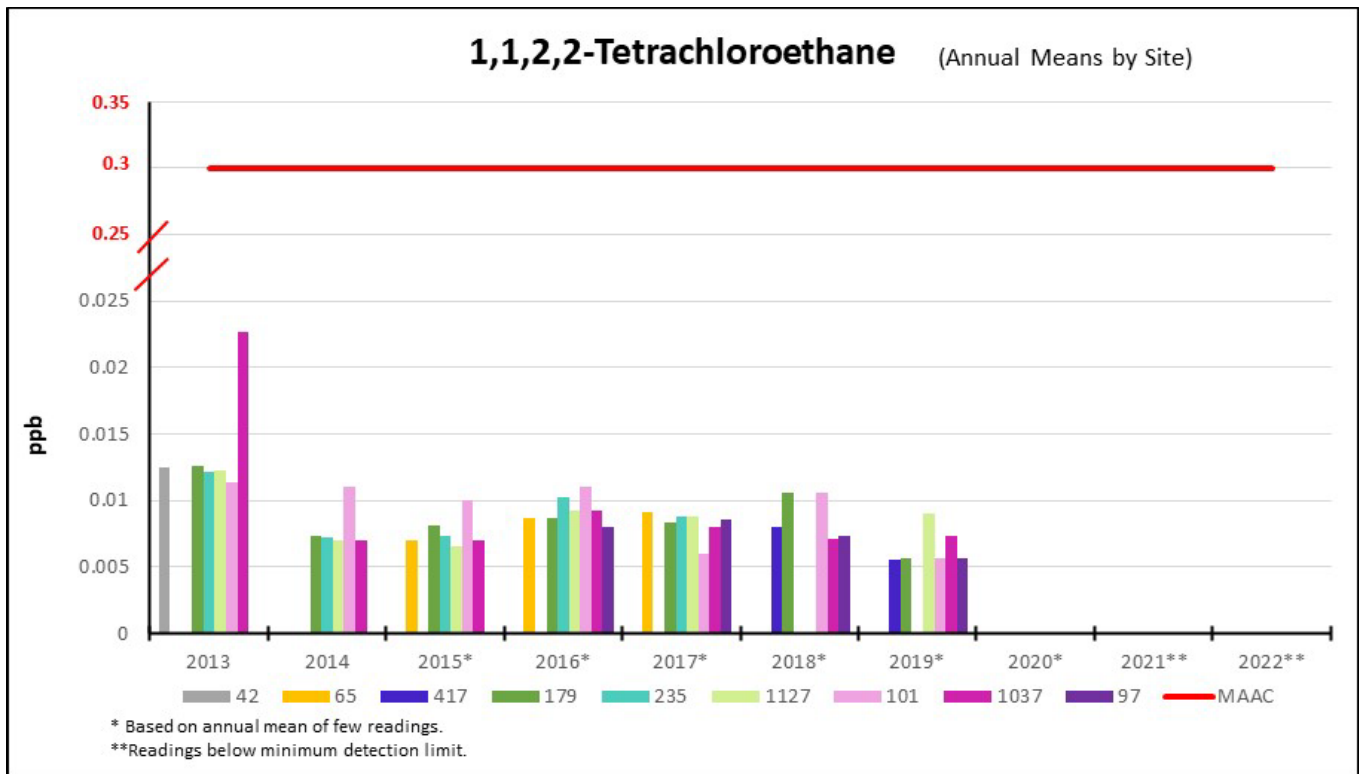
MAAC: 0.3 ppb ($2 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Used in the manufacture of trichloroethylene and perchloroethylene, as a metal degreasing agent, in paint, in varnish, in rust removers, in photographic film, as an alcohol denaturant, as an extractant, as a solvent, and as a chemical intermediate. The 2021 Air Quality Emission Inventory showed 1.341 tons reported.

HEALTH EFFECTS: Increased incidence of hepatocellular carcinomas in mice. Non-cancer effects: Chronic exposure by inhalation may cause jaundice, liver enlargement, headaches, tremors, dizziness, numbness, loss of appetite, nervousness, and drowsiness.

MONITORING METHOD: EPA TO-15.



VINYL CHLORIDE

CAS # 75-01-4

SYNONYMS: chloroethene; chloroethylene; chlorethene; ethylene monochloride; Trovidur

DESCRIPTION: formula C_2H_3Cl , mol. wt. = 62.5. Colorless, flammable gas at ambient temperature with sweet odor.

CARCINOGEN status (IRIS): KNOWN

MAAC: 9 ppb ($23 \mu g/m^3$) 24-hour average

MAAC is based on IRIS 10^{-4} inhalation risk value.

SOURCES: Used in the production and fabrication of PVC pipes, pipe fittings, and plastics. Landfills, wastewater treatment and PVC production are the primary sources. The 2021 Air Quality Emission Inventory showed 3.563 tons reported.

HEALTH EFFECTS: Development of a rare cancer, liver angiosarcoma, and a possible relationship between exposure and lung and brain cancers.

MONITORING METHOD: EPA TO-15.

