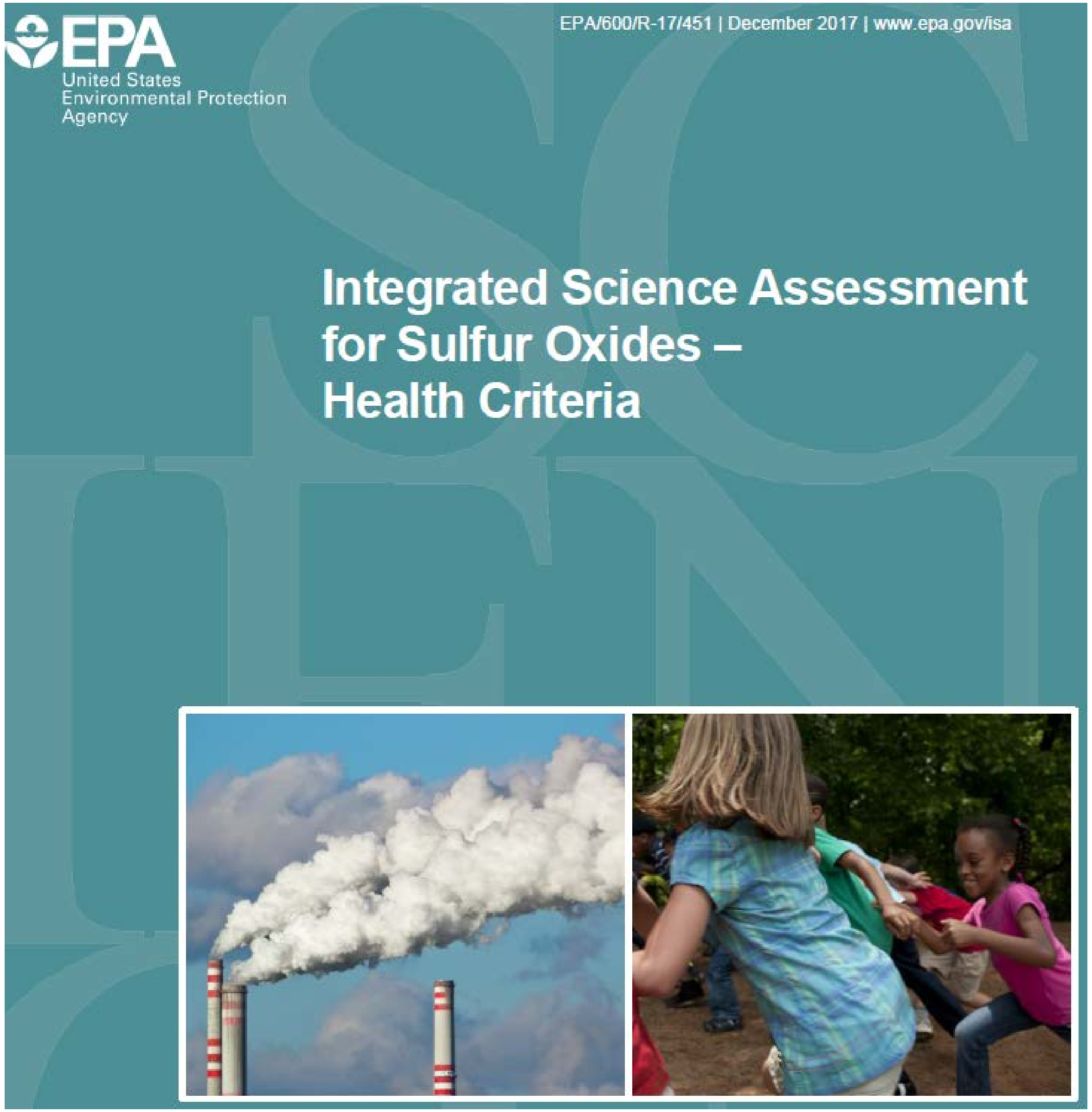
Sulfur Dioxide



https://www.epa.gov/isa/integrated-science-assessment-isa-sulfur-oxides-health-criteria

Health Effect Category[a] and Exposure Duration	Causal Determination[b]	
	2008 ISA	Current Draft ISA
Respiratory effects– Short-term exposure Section 5.2.1, Table 5-27	Causal relationship	Causal relationship
Respiratory effects– Long-term exposure Section 5.2.2, Table 5-31	Inadequate to infer the presence or absence of a causal relationship	Suggestive but not sufficient to infer a causal relationship
Cardiovascular effects– Short-term exposure Section 5.3.1, Table 5-41	Inadequate to infer the presence or absence of a causal relationship	Suggestive but not sufficient to infer a causal relationship
Cardiovascular effects– Long-term exposure Section 5.3.2, Table 5-43	Not included	Inadequate to infer the presence or absence of a causal relationship
Reproductive and developmental effects[c] Section 5.4, Table 5-46	Inadequate to infer the presence or absence of a causal relationship	Suggestive but not sufficient to infer a causal relationship
Total mortality– Short-term exposure Section 5.5.1, Table 5-51	Suggestive but not sufficient to infer a causal relationship	Suggestive but not sufficient to infer a causal relationship
Total mortality– Long-term exposure Section 5.5.2, Table 5-55	Inadequate to infer the presence or absence of a causal relationship	Suggestive but not sufficient to infer a causal relationship
Cancer– Long-term exposure Section 5.6, Table 5-56	Inadequate to infer the presence or absence of a causal relationship	Suggestive but not sufficient to infer a causal relationship

ISA = integrated Science Assessment.

[a]An array of outcomes is evaluated as part of a broad health effect category: physiological measures (e.g., airway responsiveness), clinical outcomes (e.g., hospital admissions), and cause-specific mortality. Total mortality includes all nonaccidental causes of mortality and is informed by findings for the spectrum of morbidity effects (e.g., respiratory, cardiovascular) that can lead to mortality. The sections and tables referenced include a detailed discussion of the evidence that supports the causal determinations and the SO_2 concentrations with which health effects have been associated.

[b]Since the 2008 ISA for Sulfur Oxides, the phrasing of causal determinations has changed slightly, and the weight of evidence that describes each level in the hierarchy of the causal framework has been more explicitly characterized.

[c]Reproductive and developmental effects studies consider a wide range of exposure durations.

Percentage of asthmatic adults in controlled human exposure studies experiencing SO_2-induced decrements in lung function and respiratory symptoms. EPA, 2015

Studies are grouped by SO2 concentration. Within each concentration, data is grouped by exposure time then by lung function (sRaw and FEV1).

Example: at 0.25 ppm, two exposure times were used (5, 10 min) in two studies (Bethel, Roger). Note the different ventilation rates.

SO_2 Conc (ppm)	Exposure Duration (min)	No. Subj	Ventil-ation (L/min)	Lung Func	Cumulative Percentage of Responders (Number of Subjects)[1] — sRaw: ≥100% ↑ / FEV₁: ≥15% ↓	sRaw: ≥200% ↑ / FEV₁: ≥20% ↓	sRaw: ≥300% ↑ / FEV₁: ≥30% ↓	Study
0.2	5	23	~48	sRaw	9% (2)[2]	0	0	Linn et al. (1983b)
	10	40	~40	sRaw	5% (2)	0	0	Linn et al. (1987)[3]
	10	40	~40	FEV_1	13% (5)	5% (2)	3% (1)	Linn et al. (1987)
0.25	5	19	~50–60	sRaw	32% (6)	16% (3)	0	Bethel et al. (1985)
	5	9	~80–90	sRaw	22% (2)	0	0	Bethel et al. (1985)
	10	28	~40	sRaw	4% (1)	0	0	Roger et al. (1985)

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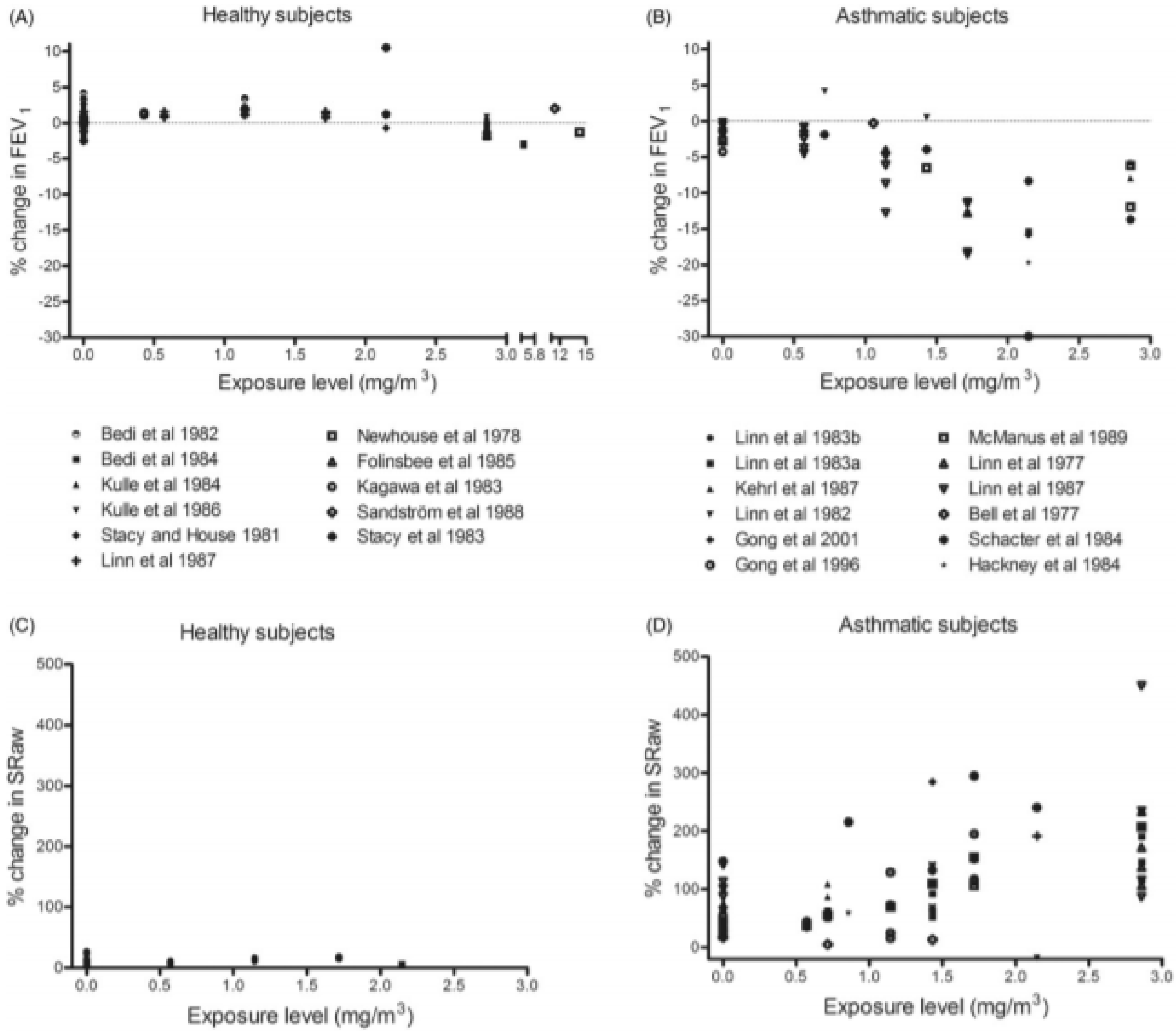
	5	9	~80–90	sRaw	22% (2)	0	0	Bethel et al. (1985)
	10	28	~40	sRaw	4% (1)	0	0	Roger et al. (1985)
0.3	10	20	~50	sRaw	10% (2)	5% (1)	5% (1)	Linn et al. (1988)[4]
	10	21	~50	sRaw	33% (7)	10% (2)	0	Linn et al. (1990)[4]
	10	20	~50	FEV_1	15% (3)	0	0	Linn et al. (1988)
	10	21	~50	FEV_1	24% (5)	14% (3)	10% (2)	Linn et al. (1990)
0.4	5	23	~48	sRaw	13% (3)	4% (1)	0	Linn et al. (1983b)
	10	40	~40	sRaw	25% (10)	8% (3)	3% (1)	Linn et al. (1987)
	10	40	~40	FEV_1	30% (12)	25% (10)	13% (5)	Linn et al. (1987)
0.5	5	10	~50–60	sRaw	60% (6)	40% (4)	20% (2)	Bethel et al. (1983)
	10	28	~40	sRaw	18% (5)	4% (1)	4% (1)	Roger et al. (1985)
	10	45	~30	sRaw	36% (16)	16% (7)	13% (6)	Magnussen et al. (1990)[6]
0.6	5	23	~48	sRaw	39% (9)	26% (6)	17% (4)	Linn et al. (1983b)
	10	40	~40	sRaw	35% (14)	28% (11)	18% (7)	Linn et al. (1987)
	10	20	~50	sRaw	60% (12)	35% (7)	10% (2)	Linn et al. (1988)
	10	21	~50	sRaw	62% (13)	29% (6)	14% (3)	Linn et al. (1990)
	10	40	~40	FEV_1	53% (21)	48% (19)	23% (9)	Linn et al. (1987)
	10	20	~50	FEV_1	55% (11)	55% (11)	5% (1)	Linn et al. (1988)
	10	21	~50	FEV_1	43% (9)	38% (8)	14% (3)	Linn et al. (1990)
1.0	10	28	~40	sRaw	50% (14)	25% (7)	14% (4)	Roger et al. (1985)[5]
	10	10	~40	sRaw	60% (6)	20% (2)	0	Kehrl et al. (1987)

Percentage change (after/before exposure x 100) in FEV1
And SRaw in healthy and asthmatic subjects following exposure by inhalation (oronasal breathing) to sulfur dioxide during exercise. Each dot represents the mean exposure of all subjects in a particular experiment or exposure level.

FEV1: forced expiratory volume in one second
SRaw: specific airway resistance

FEV1

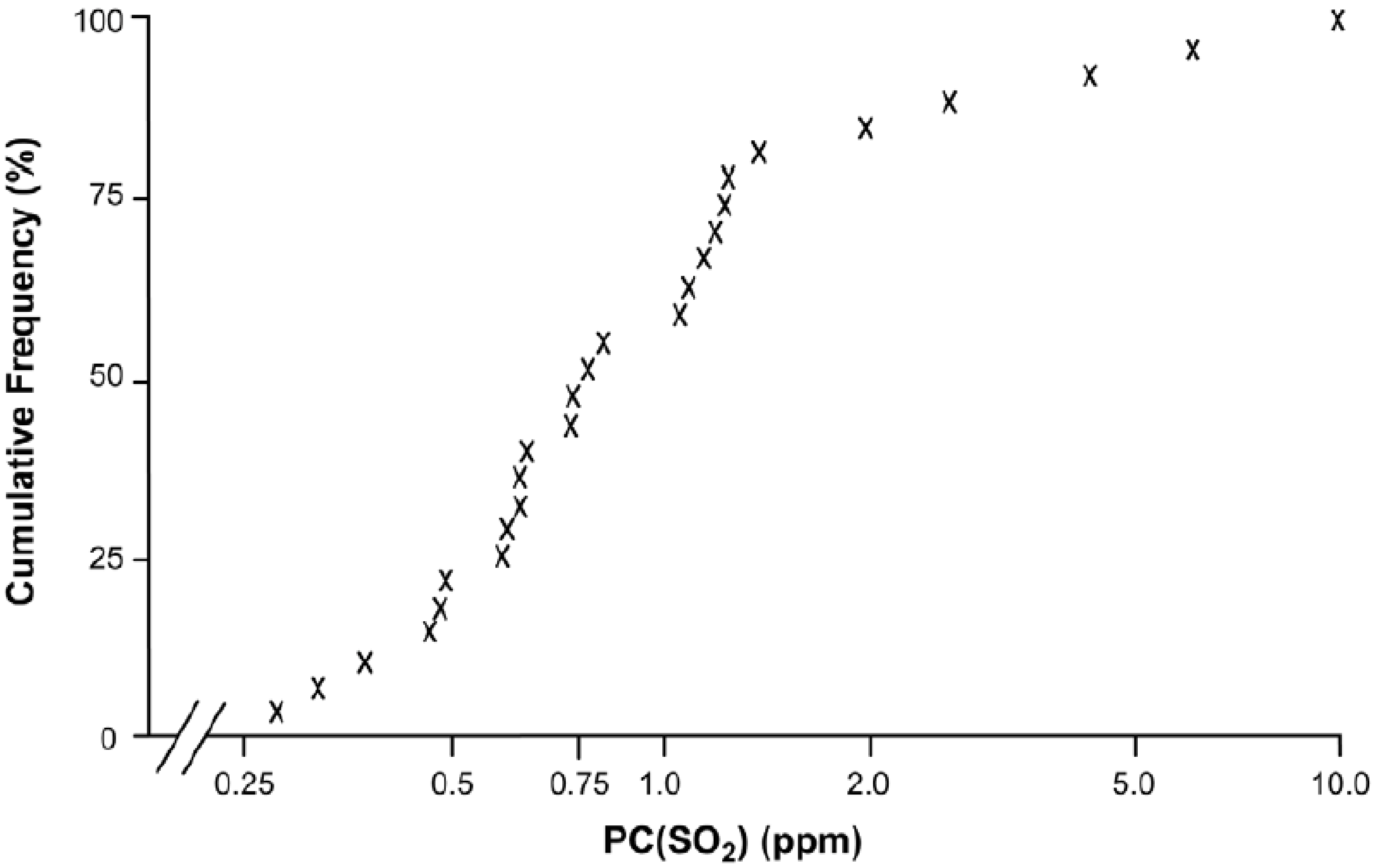
SRaw



Abstract

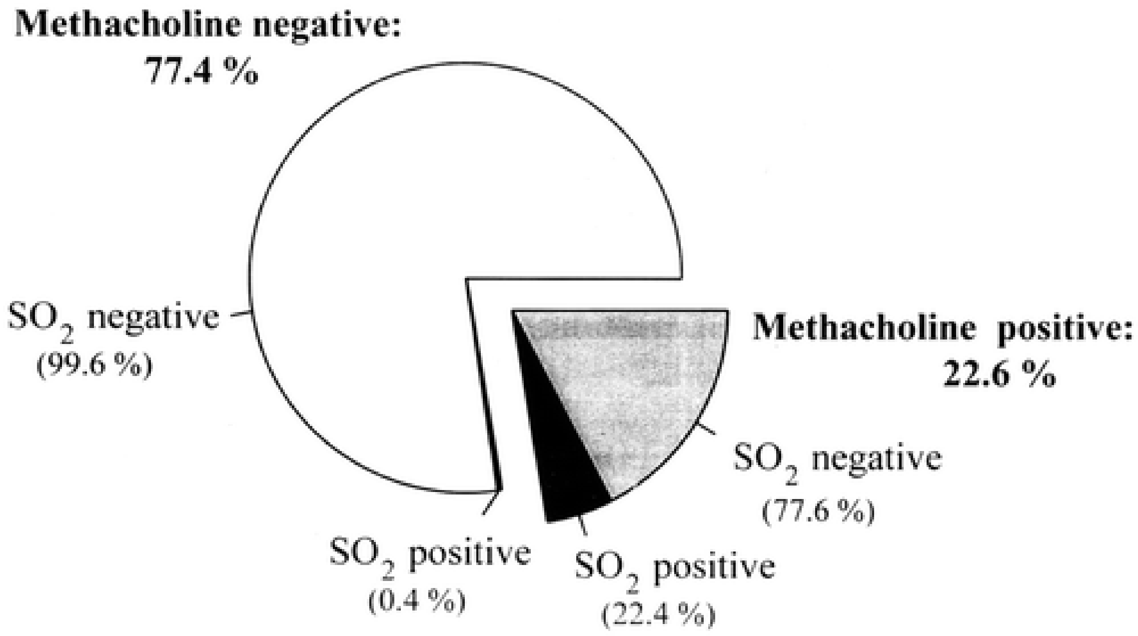
The purpose of this study was to describe for asthmatic subjects the distribution of individual bronchial sensitivity to sulfur dioxide (SO2). ***Subjects were nonsmoking male asthmatics (n = 27)*** *who were sensitive to inhaled methacholine. None of the subjects used corticosteroids or cromolyn sodium. Oral medications were with held for 48 hr, inhaled medications for 12 hr prior to all testing. Each subject participated in four separate randomly ordered 10 min exposures to 0.00, 0.25, 0.50 and 1.00 ppm SO_2at 26° C, 70% relative humidity. During exposures, subjects breathed naturally and performed moderate exercise (V_E, normalized for body surface area = 21 l/m^2 x min). Before and 3 min after exposure, specific airway resistance (SRaw) was measured by body plethysmography. Those subjects whose SRaw was not doubled by exposure to 1.00 ppm were also exposed to 2.00 ppm S02.* ***Dose response curves (relative change in SRaw, corrected for change in clean air vs S02 concentration)*** *were constructed for each subject. Bronchial sensitivity to SO_2 [PC(SO2)], defined as the concentration of S02 which provoked an increase in SRaw 100% greater than the response to clean air, was determined.* ***Substantial variability in sensitivity was observed: for 23 subjects, PC(SO2) ranged between 0.28 and 1.90 ppm, while for the remaining 4 subjects, it was greater than 2.00-ppm S02. The median PC(SO2) was 0.75 ppm SO_2, and 6 subjects had a PC(SO_2) of less than 0.50 ppm****. PC(SO_2) was not related (r = 0.31) to airway sensitivity to methacholine.*

Cumulative Distribution of SO2 response among 27 male asthmatics



https://www.ncbi.nlm.nih.gov/pubmed/3787660

We determined the prevalence of airway hyperresponsiveness to sulfur dioxide (SO_2) in an adult population sample of **790 subjects 20 to 44 yr of age**. Subjects were drawn randomly from the population of Hamburg, Northern Germany, within the framework of the European Community Respiratory Health Survey. In addition, we analyzed the relationship between SO_2 responsiveness and a number of risk factors, such as a history of respiratory symptoms, methacholine responsiveness, and atopy derived from skin-prick test results. SO_2 inhalation challenges were performed during isocapnic hyperventilation at constant rate (40 L · min^{-1}, for 3 min) with doubling concentrations of SO_2 up to a maximum concentration of 2.0 ppm. If subjects achieved a 20% decrease in FEV_1 from baseline during the challenge, they were considered to be hyperresponsive to SO_2. **The raw prevalence of SO_2 hyperresponsiveness within the population sample studied was 3.4% (95% confidence interval [CI]: 2.3 to 5.0%). Adjustment for nonparticipation led to an estimated prevalence of SO_2 hyperresponsiveness of 5.4%.** Among subjects with hyperresponsiveness to methacholine, 22.4% (95% CI: 20.1 to 25.3) demonstrated hyperresponsiveness to SO_2. There was no significant correlation between the degrees of hyperresponsiveness to methacholine and SO_2. Predictors of a positive SO_2 response were hyperresponsiveness to methacholine ($p < 0.0001$), a positive history of respiratory symptoms ($p < 0.05$), and a positive skin-prick test to at least one common allergen ($p < 0.05$). We conclude from these data that airway hyperresponsiveness to SO_2 can be found in about 20 to 25% of subjects within the 20- to 44-yr age range who are hyperresponsive to methacholine.



https://www.atsjournals.org/doi/full/10.1164/ajrccm.156.4.9607025

Factor of 10 in SO2 sensitivity between asthmatics and healthy subjects.

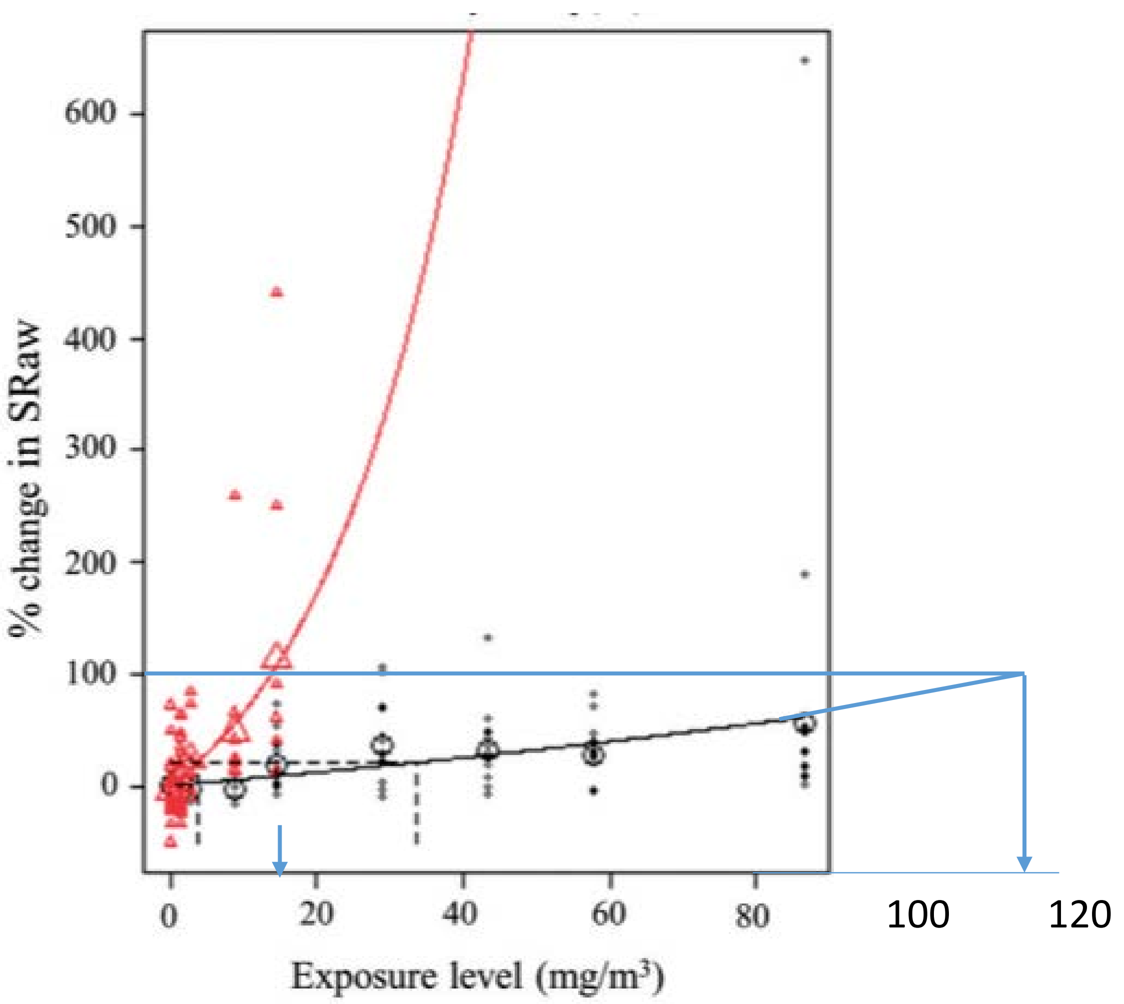


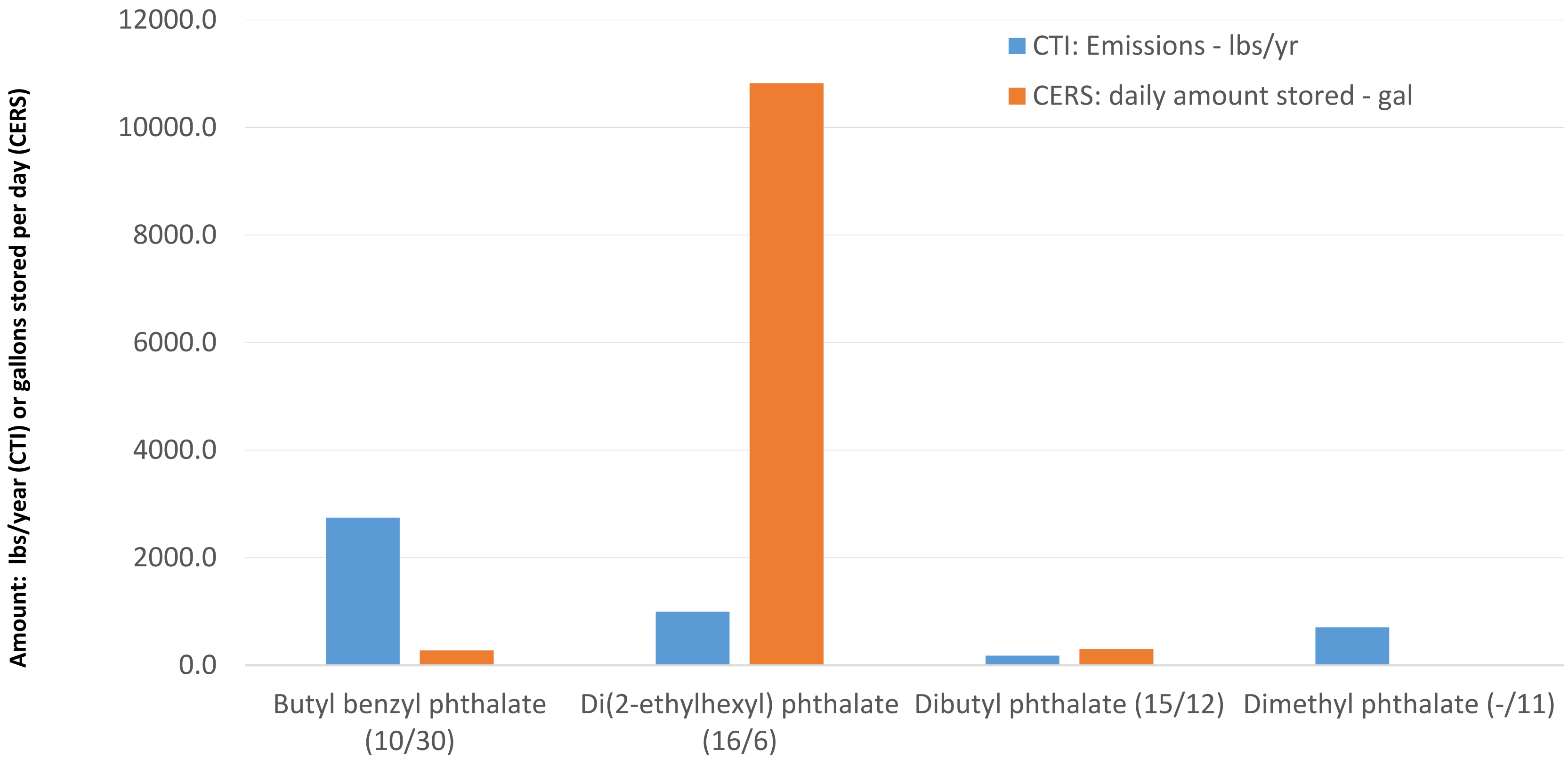
Figure 11. Benchmark concentration analysis of the increase in SRaw following exposure by inhalation to various levels of sulfur dioxide (in a chamber with a noseclip at rest). The upper and lower curves represent the best fits to the experimental data for asthmatics (Δ), and healthy subjects (o), respectively. The larger symbols depict mean values.

California Labor Code section 144.6

In promulgating standards dealing with toxic materials or harmful physical agents, the board shall adopt that standard which most adequately assures, to the extent feasible, that **no employee** will suffer material impairment of health or functional capacity even if such employee has regular exposure to a hazard regulated by such standard for the period of his working life. Development of standards under this section shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the employee, other considerations shall be the latest available scientific data in the field, the reasonableness of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

Di(2-ethylhexyl) phthalate

CTI and CERS phthalate average “usage” (CTI/CERS number of users)



Not in CERS?

- Different terms– no CAS number entered, different chemical name, acronym used, misspelling.   “DEHP”

- Chemical not reported – product name given but no chemical ingredients – “plastisol”

- Failure to report - medical device makers

Automobile Manufacturer

CERS

betafoam 89100N Prepolymer	4800	pounds
clear gorilla glue	0.0104	gallons
clear gorilla glue	0.0273	gallons
Dibasic Ester	110	gallons
Diisononyl Phtalate	110	gallons
Enviro-gel	0.2496	gallons

CTI

YEAR	CO	AB	DIS	FACID	FNAICS	NAICSN	FSIC	SICN	POLN	EMISSIONS (lb/yr)
2016	1	SF	BA	20459	336111	Automobile Manufacturing	3711	MOTOR VEHICLES AND CAR BODIES	Di(2-ethylhexyl) phthalate	11.7

X manufactures flexible and rigid vinyl, thermoplastic elastomers (TPE), nylons, color master batches, specialty chemicals, and hoses. Its vinyl compounds are used in applications ranging from wire and cable products to automotive, medical, consumer, and industrial products. The company also provides custom and standard colors and additives, as well as special effects for coloring various polymers, including polyethylene, polypropylene, polystyrene, ABS, engineering thermoplastics, and TPEs; and nylon resins for home, highway, and industrial environments. The company manufactures esters for plasticizers, synthetic lubricants, and polymer intermediates markets.

Facility Name:			
Business Name:			
CUPA:		Los Angeles County Fire Department	
DOT Hazard Class	**Common Name**	**Max Daily Amount**	**Units**
No DOT Hazard Class Provided			
	Acrylic Polymer	7000	pounds
	CALCIUM CARBONATE (Bulk)	190000	pounds
	CALCIUM CARBONATE (NON BULK)	60000	pounds
	CALCIUM CARBONATE (Bulk)	80000	pounds
	CARBON BLACK	2000	pounds
	CARBON BLACK	2000	pounds
	DEHP	500000	pounds
	ZINC COMPOUNDS	39000	pounds
	CHIMASSORB	2000	pounds
	MARK QTS	2000	pounds
	VINYZENE	4724	pounds
	PARALOID	16000	pounds
	MBS CLEAR MODIFIER	6000	pounds
	PKP 1927	25000	pounds
	Therm Chek	26000	pounds
	EBS	3000	pounds
	Methyl Tin Stablizer	4000	gallons
	Stearic Acid Flakes	6000	pounds

- Biggest emitter of butyl benzyl phthalate in CTI but no record of phthalate in CERS report
- NAICS: Commercial Flexographic Printing; plastisol inks can be 30-40% phthalate
- 50 Plastisol reports in San Diego County database had no record of ingredients

Hazardous Materials Inventory (7) ⚠ Submitted Dec. 27, 2018

	Common Name	CAS	Location	Max Daily Amount
View	Waste Solvent ⚠		Inside West Rear of Bldg	440 gallons
View	Waste Ink		Inside West Rear of Bldg	110 gallons
View	Plastisol Screen Printing Inks		Inside West Rear of Bldg	500 gallons
View	Emulsion Remover		Inside West Rear of Bldg	55 gallons
View	Spot Remover ⚠		Inside West Rear of Bldg	55 gallons
View	Press/Screen Wash ⚠		Inside West Rear of Bldg	55 gallons
View	Screen Wash/ Stain Remover		Inside West Rear of Bldg	55 gallons

HMIS Matrix Report | Export To Excel

1 | 10 items per page | 1 - 7 of 7 items

Medical Device Maker - “FDA QSR compliant and ISO 13485 certified, one-stop source medical device packaging company located in Anaheim, California. Products are manufactured in Class 7 (10,000) and Class 8 (100,000) certified environments with full traceability”.

Company not listed in CERS. Anaheim Fire Department had no CERS records for facility. AFD contacted facility which acknowledged it used plastic sheets containing phthalates.

2019 PEL Prioritization

See Prioritization Spreadsheet

California Toxics Inventory Chemicals with emissions >1000 lbs/yr; HEAC P2 substances in bold.

POLN	Emissions	POLN	Emissions	POLN	Emissions	POLN	Emissions
Carbon dioxide	268736447	Acetaldehyde	79990	Sodium hydroxide	14410	Nickel	4309
Ammonia	13332089	n-Butyl alcohol	73311	Diesel engine exhaust, gas	14068	Nitrous oxide	4230
Methane	7124176	Methyl isobutyl ketone	65681	Freon 11	14050	Copper	4142
Hydrogen sulfide	2044239	Aluminum	64392	Manganese	13748	EGME	4033
Carbon monoxide	1514956	Lead	49286	Hydrocyanic acid	12939	Sulfur dioxide	3898
Isopropyl alcohol	883297	Nitric acid	43991	Vinyl chloride	12893	Vanadium pentoxide	3480
Toluene	715425	Phosphine	39764	1,3-Butadiene	11344	Dimethyl formamide	3184
Silica, crystalline (resp)	677687	Sulfuric acid	39386	1,4-Dioxane	10452	EGMEA	2915
Formaldehyde	650145	Glycol ethers (and acetates)	37426	Diethanolamine	10331	**Butyl benzyl phthalate**	2745
Hydrochloric acid	643787	1,2,4-Trimethylbenzene	36435	Isocyanates	9653	PAHs, total, w/o individ.	2373
Hexane	584396	Ethyl Alcohol	36157	Chlorine	8130	PAHs, total, with individ.	2329
Xylenes (mixed)	465297	Acrolein	33813	Dichlorodifluoromethane	7781	Methyl chloride	2262
Styrene	365357	Ethylene glycol	33674	Epoxy resins	7741	Vinyl acetate	2259
Gasoline vapors	267147	Hydrogen fluoride	33542	Carbon tetrachloride	7619	Aluminum oxide (fibrous)	2115
Diesel exhaust, part.	257179	PGMEA	33052	Dimethyl sulfide	5861	Hydrochlorofluorocarbons	2084
Methanol	239576	Methyl chloroform	32681	N,N-Dimethylethanolamine	5670	Benzo[a]pyrene	1997
Benzene	219784	PGME	27592	Phosphoric acid	5577	Chlorobenzene	1857
Nitrogen dioxide	200261	Trichloroethylene	26712	**DGME**	**5550**	Coal tars	1734
Methyl ethyl ketone	184589	Biphenyl	25669	Ethylene	5509	MDI	1728
Propylene	173089	Cyclohexane	24523	PCBTF	5482	**Toluene diisocyanates**	1694
Perchloroethylene	167306	Phenol	23578	2,2,4-Trimethylpentane	5116	1,1-Dichloroethane	1644
Acetone	151741	Oleum	22184	Zinc oxide	5035	Carbon disulfide	1417
Methylene chloride	143766	Chloroform	22055	Methyl tert-butyl ether	4622	Mercury	1350
Ammonium sulfate	138226	Propylene oxide	21887	Freon 22	4505	Ethyl chloride	1348
Perfluorocarbons	125530	Zinc	19805	Barium	4421	m-Xylene	1335
Methyl bromide	123484	Naphthalene	19589	Ethylene dichloride {EDC}	4400	Trimethylbenzenes	1249
EGME	117262	Fluorocarbons (chlorinated)	19331	p-Dichlorobenzene	4332	sec-Butyl alcohol	1137
Ethyl benzene	85821	Methyl methacrylate	18688	Fluorides and compounds	4328	Gasoline engine exhaust,	1061