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Supplemental Material

Health Effects of Naphthalene Exposure: A Systematic Evidence Map and Analysis of Potential Considerations for Dose–Response Evaluation

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Table S8. Summary of eight human studies that did not report any of the health systems selected for further evaluation. These studies did not undergo study evaluation.

Appendix: Reference Values Identified for Naphthalene

Table A1. Details on derivation of the available health effect reference values for inhalation exposure to naphthalene (from Figure 1 of the main text) (continued on following pages).

Table A2. Details on derivation of the available health effect reference values for oral exposure to naphthalene (from Figure 2 of the main text).

Table A3. Details on additional inhalation values based on another agency's values or lacking derivation descriptions (continued on following pages).

References

Additional File- Excel Document

1. Survey of existing reference values for naphthalene

Table S1: Sources searched for naphthalene heath effect reference values

Source	Search Results	Reference
American Conference of Governmental Industrial Hygienists (ACGIH)	See Appendix Table A1.	ACGIH (2007)
American Industrial Hygiene Association (AIHA)	No search results found	AIHA (2016)
Agency for Toxic Substances and Disease Registry (ATSDR)	See Appendix Tables A1 and A2.	ATSDR (2021b)
		ATSDR (2021a)
California Environmental Protection Agency (CalEPA)	See Appendix Table A1.	CalEPA (2021)
Connecticut Department of Energy & Environmental Protection (CT DEEP)	See Appendix Tables A1 and A2.	CT DEEP (2015)
		CT DEEP (2018)
Deutsche Forschungsgemeinschaft, German Research Foundation (DFG)	No search results found	DFG (2020)
Drinking Water Standards and Health Advisories (DWSHA)	See Appendix Table A2.	U.S. EPA (2018a)
Acute Exposure Level Guidelines from the U.S. Environmental Protection Agency and National Research Council) (EPA/NRC AEGL)	No search results found	U.S. EPA (2018b)
Health Canada	See Appendix Table A1.	Government of Canada (2021)
	No values found	Health Canada (2020)
	No values found	Health Canada (1996)
Health and Safety Authority (HSA)	See Appendix Table A1.	HSA (2020)
Health and Safety Laboratory (HSL)	No values found	HSL (2002)
Indiana Department of Environmental Management (IDEM)	See Appendix Table A1.	IDEM (2019)
Idaho Department of Environmental Quality (ID DEQ)	See Appendix Table A3.	Idaho DEQ (2019)
Institut für Arbeitsschutz, The Institute for Occupational Safety and Health (IFA)	See Appendix Table A3.	IFA (2020)
Integrated Risk Information System (IRIS)	See Appendix Tables A1 and A2.	U.S. EPA (2021a)

Source	Search Results	Reference
International Toxicity Estimates for Risk (ITER)	No unique search results found	TERA (2021)
Japan Society for Occupational Health (JSOH)	No values found	JSOH (2017)
Massachusetts Department of Environmental Protection (MassDEP)	See Appendix Table A3.	MassDEP (2019)
Minnesota Department of Health (MDH)	See Appendix Table A1.	MDH (2019)
Michigan Department of Environment, Great Lakes & Energy (MI EGLE)	See Appendix Tables A1 and A2.	Michigan DEQ (2016)
National Air Toxics Information Clearinghouse (NATICH)	See Appendix Tables A1 and A3.	U.S. EPA (1993)
North Carolina Department of Environmental Quality (NC DEQ)	No values found	NC Department of Environmental Quality (2014)
Nevada Division of Environmental Protection (NDEP)	See Appendix Table A1.	NDEP (2017)
National Institute for Occupational Safety and Health (NIOSH)	See Appendix Table A1.	NIOSH (2019)
New Jersey Department of Environmental Protection (NJ DEP)	See Appendix Table A1.	NJ DEP (2020)
New York State Department of Environmental Conservation (NY DEC)	See Appendix Tables A1 and A2.	NYSDEC (2006)
Office of Air Quality Planning and Standards (OAQPS)	No unique search results found	U.S. EPA (2020)
Ontario Ministry of Labour	See Appendix Table A1.	Ontario Ministry of Labour (2020)
Office of Pesticide Programs (OPP)	See Appendix Table A2.	U.S. EPA (2021b)
Oregon Department of Environmental Quality (OR DEQ)	See Appendix Table A1.	Oregon DEQ (2018)
Occupational Safety and Health Administration (OSHA)	See Appendix Table A1.	OSHA (2019)
		OSHA (2020a)
		OSHA (2020b)
Protective Action Criteria (PAC) Database	See Appendix Table A1.	DOE (2018)
Publications Quebec	See Appendix Table A1.	Légis Québec (2020)
Rhode Island Department of Environmental Management (RI DEM)	See Appendix Table A1.	RI DEM (2008)
*Rijksinstituut voor Volksgezondheid en Milieu (*RIVM), The Netherlands Institute for Public Health and the Environment	No values found	Tiesjema and Baars (2009)
	See Appendix Table A1.	Dusseldorp et al. (2011)
	No values found	RIVM (2001)

Source	Search Results	Reference
Safe Work Australia	See Appendix Table A1.	Safe Work Australia (2019)
Southwest Clean Air Association (SWCAA)	See Appendix Table A3.	SWCAA (2021)
Texas Commission on Environmental Quality (TCEQ)	No values found	TCEQ (2020)
	See Appendix Tables A1 and A2.	TCEQ (2018)
United States Army Public Health Center (USAPHC)	See Appendix Table A3.	U.S. APHC (2013)
Vermont Department of Environmental Conservation (VT DEC)	See Appendix Table A3.	VT ANR (2018)
Washington State Dept. of Ecology	See Appendix Table A3.	Washington State Legislature (2009)
Worksafe	See Appendix Table A1.	Worksafe (2018)
World Health Organization (WHO)	No values found	WHO (2017)
		WHO (2021)

2. Literature search and screening

Table S2. Database search strategy

Database Search Date	**Query String**
PubMed	
1/28/2021	("naphthalene"[nm] AND 2018/12/01 : 2021/01/31[mhda]) OR (("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND "Naphthalenes"[mh:noexp] AND 2018/12/01 : 2021/01/31 [mhda]) OR ((("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2018/12/01 : 2021/01/31[edat] OR 2018/12/01 2021/01/31[crdt])) NOT medline[sb])
2/8/2019	("naphthalene"[nm] AND 2017/10/01 : 2019/01/01[mhda]) OR (("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND "Naphthalenes"[mh:noexp] AND 2017/10/01 : 2019/01/01[mhda]) OR ((("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2017/10/01 : 2019/01/01[edat] OR 2017/10/01 : 2019/01/01[crdt])) NOT medline[sb])
9/29/2017	("naphthalene"[nm] AND 2017/02/01 : 3000[mhda]) OR (("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND "Naphthalenes"[mh:noexp] AND 2017/02/01 : 3000[mhda]) OR ((("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2014/10/01 : 3000[edat] OR 2017/02/01 : 3000[crdt])) NOT medline[sb])

Database Search Date	**Query String**
01/04/2017	((524-42-5[rn] OR 130-15-4[rn] OR 7234-04-0[rn] OR 277-50-9[rn]) OR (("1,2-Dihydro-1,2-diketo-naphthalene"[tw] OR "1,2-Naphthalenedione"[tw] OR "1,2-Naphthaquinone"[tw] OR "beta-Naphthoquinone"[tw] OR "o-Naphthoquinone"[tw] OR "1,4-Dihydro-1,4-diketonaphthalene"[tw] OR "1,4-Naphthalenedione"[tw] OR "1,4-Naphthoquinone"[tw] OR "1,4-Naphthylquinone"[tw] OR "alpha-Naphthoquinone"[tw] OR "p-Naphthoquinone"[tw] OR "1,2-Dihydronaphthalene-1,2-diol"[tw] OR "1,2-Dihydroxy-1,2-dihydronaphthalene"[tw] OR "1,2-dihydro-1,2-Naphthalenediol"[tw] OR "Naphthalene-1,2-dihydrodiol"[tw] OR "trans-1,2-Dihydroxy-1,2-dihydronaphthalene"[tw] OR "Naphthalene 1,2-oxide"[tw] OR "Naphthalene oxide"[tw] OR "Naphth(1,2-b)oxirene"[tw]) NOT medline[sb])) OR (("naphthalene"[nm] AND 2015/10/01 : 3000[mhda]) OR (("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND "Naphthalenes"[mh:noexp] AND 2015/10/01 : 3000[mhda]) OR ((("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2015/10/01 : 3000[edat] OR 2015/10/01 : 3000[crdt])) NOT medline[sb]))
11/06/2015	("naphthalene"[nm] AND 2014/10/01 : 3000[mhda]) OR (("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND "Naphthalenes"[mh:noexp] AND 2014/10/01 : 3000[mhda]) OR ((("naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2014/10/01 : 3000[edat] OR 2014/10/01 : 3000[crdt])) NOT medline[sb])
12/16/2014	("naphthalene"[nm] AND 2012/12/01 : 3000[mhda]) OR ("Naphthalenes"[mh:noexp] AND ("91-20-3"[tw] OR "naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND 2012/12/01 : 3000[mhda]) OR ((("91-20-3"[tw] OR "naphthalene"[tw] OR "albocarbon"[tw] OR "naphthalin"[tw] OR "naphthaline"[tw] OR "naphthene"[tw] OR "naphtalene"[tw] OR "camphor tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR "mothballs"[tw] OR "Naphtalinum"[tw] OR "Naphthalinum"[tw] OR "Dezodorator"[tw] OR "Mighty 150"[tw] OR "Mighty RD1"[tw]) AND (2012/12/01 : 3000[crdat] OR 2012/12/01 : 3000[edat])) NOT medline[sb])

Database Search Date	**Query String**
02/17/2013	(((91-20-3[rn]) OR (("91-20-3"[tw] OR naphthalene[tw] OR albocarbon[tw] OR naphthalin[tw] OR naphthaline[tw] OR naphthene[tw] OR naphtalene[tw] OR "camph[tw] OR tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR mothballs[tw]) AND ("naphthalenes"[mh:noexp]))) AND (("naphthalenes/toxicity"[MeSH Terms] OR "naphthalenes/adverse effects"[MeSH Terms] OR "naphthalenes/poisoning"[MeSH Terms] OR "naphthalenes/pharmacokinetics"[MeSH Terms]) OR ("naphthalenes/blood"[MeSH Terms] OR "naphthalenes/cerebrospinal fluid"[MeSH Terms] OR "naphthalenes/urine"[MeSH Terms]) OR ("naphthalenes/metabolism"[MeSH Terms] AND ("humans"[MeSH Terms] OR "animals"[MeSH Terms])) OR ("naphthalenes/antagonists and inhibitors"[MeSH Terms]) OR ("chemically induced"[MeSH Subheading] OR "environmental exposure"[MeSH Terms]) OR ("endocrine system"[mh] OR "hormones, hormone substitutes, and hormone antagonists"[mh] OR "endocrine disruptors"[mh]) OR (cancer[sb]) OR ("Computational biology"[mh] OR "Medical Informatics"[mh] OR Genomics[mh] OR Genome[mh] OR Proteomics[mh] OR Proteome[mh] OR Metabolomics[mh] OR Metabolome[mh] OR Genes[mh] OR "Gene expression"[mh] OR Phenotype[mh] OR genetics[mh] OR genotype[mh] OR Transcriptome[mh] OR ("Systems Biology"[mh] AND ("Environmental Exposure"[mh] OR "Epidemiological Monitoring"[mh] OR analysis[sh])) OR "Transcription, Genetic "[mh] OR "Reverse transcription"[mh] OR "Transcriptional activation"[mh] OR "Transcription factors"[mh] OR ("biosynthesis"[sh] AND (RNA[mh] OR DNA[mh])) OR "RNA, Messenger "[mh] OR "RNA, Transfer"[mh] OR "peptide biosynthesis"[mh] OR "protein biosynthesis"[mh] OR "Reverse Transcriptase Polymerase Chain Reaction"[mh] OR "Base Sequence"[mh] OR "Trans-activators"[mh] OR "Gene Expression Profiling"[mh]) OR (rat[tw] OR rats[tw] OR mouse[tw] OR mice[tw] OR muridae[tw] OR rabbit[tw] OR rabbits[tw] OR hamster[tw] OR hamsters[tw] OR ferret[tw] OR ferrets[tw] OR gerbil[tw] OR gerbils[tw] OR rodent[tw] OR rodents[tw] OR rodentia[tw] OR dog[tw] OR dogs[tw] OR beagle[tw] OR beagles[tw] OR canine[tw] OR cats[tw] OR feline[tw] OR pig[tw] OR pigs[tw] OR swine[tw] OR porcine[tw] OR monkey[tw] OR monkeys[tw] OR macaque[tw] OR macaques[tw] OR baboon[tw] OR baboons[tw] OR marmoset[tw] OR marmosets[tw] OR "animals, laboratory"[mh]) OR (((pharmacokinetics[mh] OR metabolism[mh]) AND (humans[mh] OR animals[mh])) OR "dose-response relationship, drug"[mh] OR risk[mh]))) OR (("91-20-3"[tw] OR naphthalene[tw] OR albocarbon[tw] OR naphthalin[tw] OR naphthaline[tw] OR naphthene[tw] OR naphtalene[tw] OR "camph[tw] OR tar"[tw] OR "tar camphor"[tw] OR "white tar"[tw] OR "moth balls"[tw] OR "moth flakes"[tw] OR mothballs[tw]) NOT medline[sb])
Web of Science	
1/28/2021	(TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR "Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Veterinary Sciences" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR

Database Search Date	**Query String**
	"Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset* OR TS=toxic*) AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS="mother" OR TS="fetal" OR TS="fetus" OR TS="citizens" OR TS="milk" OR TS="formula")) AND PY=(2019-2021)
2/8/2019	(TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC="Toxicology" OR WC="Endocrinology & Metabolism" OR WC="Gastroenterology & Hepatology" OR WC="Gastroenterology & Hepatology" OR WC="Hematology" OR WC="Neurosciences" OR WC="Obstetrics & Gynecology" OR WC="Pharmacology & Pharmacy" OR WC="Physiology" OR WC="Respiratory System" OR WC="Urology & Nephrology" OR WC="Anatomy & Morphology" OR WC="Andrology" OR WC="Pathology" OR WC="Otorhinolaryngology" OR WC="Ophthalmology" OR WC="Pediatrics" OR WC="Oncology" OR WC="Reproductive Biology" OR WC="Developmental Biology" OR WC="Biology" OR WC="Dermatology" OR WC="Allergy" OR WC="Public, Environmental & Occupational Health" OR SU="Anatomy & Morphology" OR SU="Cardiovascular System & Cardiology" OR SU="Developmental Biology" OR SU="Endocrinology & Metabolism" OR SU="Gastroenterology & Hepatology" OR SU="Hematology" OR SU="Immunology" OR SU="Neurosciences & Neurology" OR SU="Obstetrics & Gynecology" OR SU="Oncology" OR SU="Ophthalmology" OR SU="Pathology" OR SU="Pediatrics" OR SU="Pharmacology & Pharmacy" OR SU="Physiology" OR SU="Public, Environmental & Occupational Health" OR SU="Respiratory System" OR SU="Toxicology" OR SU="Urology & Nephrology" OR SU="Reproductive Biology" OR SU="Dermatology" OR SU="Allergy") OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR

Database Search Date	**Query String**
	TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula)) OR TI=toxic*) AND PY=(2017-2019)
9/29/2017	(TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR "Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR "Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula)) OR TI=toxic*) AND PY=(2017-2017)
01/04/2017	(TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR

Database Search Date	**Query String**
	"Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR "Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula)) OR TI=toxic*) AND PY=(2015-2017)
11/04/2015	(TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR "Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR "Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR

Database Search Date	**Query String**
	TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula)) OR TI=toxic*) AND PY=(2014-2016)
12/16/2014	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS="mothballs" OR TS="Naphtalinum" OR TS="Naphthalinum" OR TS="Dezodorator" OR TS="Mighty 150" OR TS="Mighty RD1") AND ((WC=("Toxicology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Neurosciences" OR "Obstetrics & Gynecology" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Respiratory System" OR "Urology & Nephrology" OR "Anatomy & Morphology" OR "Andrology" OR "Pathology" OR "Otorhinolaryngology" OR "Ophthalmology" OR "Pediatrics" OR "Oncology" OR "Reproductive Biology" OR "Developmental Biology" OR "Biology" OR "Dermatology" OR "Allergy" OR "Public, Environmental & Occupational Health") OR SU=("Anatomy & Morphology" OR "Cardiovascular System & Cardiology" OR "Developmental Biology" OR "Endocrinology & Metabolism" OR "Gastroenterology & Hepatology" OR "Hematology" OR "Immunology" OR "Neurosciences & Neurology" OR "Obstetrics & Gynecology" OR "Oncology" OR "Ophthalmology" OR "Pathology" OR "Pediatrics" OR "Pharmacology & Pharmacy" OR "Physiology" OR "Public, Environmental & Occupational Health" OR "Respiratory System" OR "Toxicology" OR "Urology & Nephrology" OR "Reproductive Biology" OR "Dermatology" OR "Allergy")) OR (WC="veterinary sciences" AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*)) OR (TS=toxic* AND (TS="rat" OR TS="rats" OR TS="mouse" OR TS="murine" OR TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset*) OR (TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS="WORKER" OR TS="WORKERS" OR TS="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=fetus OR TS=citizens OR TS=milk OR TS=formula)) OR TI=toxic*)) AND PY=2012-2015
02/21/2013	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="chronic" OR TS=immun* OR TS=lymph* OR TS=neurotox* OR TS=toxicokin* OR TS=pharmacokin* OR TS=biomarker* OR TS=neurolog* OR TS="subchronic" OR TS="pbpk" OR TS=epidemiolog* OR TS="acute" OR TS="subacute" OR TS="ld50")

Database Search Date	**Query String**
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="lc50" OR TS=inhal* OR TS=pulmon* OR TS="nasal" OR TS=lung* OR TS=respir* OR TS=occupation* OR TS="workplace" OR TS=worker* OR TS="oral" OR TS="orally" OR TS=ingest* OR TS="gavage" OR TS="diet" OR TS="diets" OR TS="dietary" OR TS="drinking" OR TS=gastr* OR TS=intestin* OR TS=liver* OR TS=hepat* OR TS=kidney* OR TS=nephr*)
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="gut" OR TS=sensitiz* OR TS=abort* OR TS=abnormalit* OR TS=embryo* OR TS=cleft* OR TS=fetus* OR TS=foetus* OR TS=fetal* OR TS=foetal* OR TS=fertilit* OR TS=infertil* OR TS="fertilization" OR TS="fertilisation" OR TS=malform* OR TS="ovum" OR TS="ova" OR TS="ovary" OR TS="ovaries" OR TS="ovarian" OR TS=placenta* OR TS=pregnan*)
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS=dermal* OR TS="dermis" OR TS="skin" OR TS=epiderm* OR TS="cutaneous" OR TS=carcinog* OR TS=cocarcinog* OR TS="cancer" OR TS="precancer" OR TS=neoplas* OR TS=tumor* OR TS=tumour* OR TS=oncogen* OR TS=lymphoma* OR TS=carcinom* OR TS=genetox* OR TS=genotox* OR TS=mutagen* OR TS=nephrotox* OR TS=hepatotox* OR TS=endocrin* OR TS=estrogen* OR TS=androgen*)
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS=hormon* OR TS="blood" OR TS="serum" OR TS="urine" OR TS="bone" OR TS="bones" OR TS=skelet* OR TS="rat" OR TS="rats" OR TS="mouse")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="mice" OR TS="guinea" OR TS="muridae" OR TS=rabbit* OR TS=lagomorph* OR TS=hamster* OR TS=ferret* OR TS=gerbil* OR TS=rodent* OR TS="dog" OR TS="dogs" OR TS=beagle* OR TS="canine" OR TS="cats" OR TS="feline" OR TS="pig" OR TS="pigs" OR TS="swine" OR TS="porcine" OR TS=monkey* OR TS=macaque* OR TS=baboon* OR TS=marmoset* OR TS=toxic* OR TS="adverse" OR TS="poisoning")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="prenatal" OR TS="perinatal" OR TS="postnatal" OR TS="reproduce" OR TS=reproduct* OR TS=steril* OR TS=teratogen* OR TS=sperm* OR TS=neonat* OR TS=newborn*

Database Search Date	**Query String**
	OR TS=development* OR TS=zygote* OR TS="child" OR TS="children" OR TS=adolescen* OR TS=infant* OR TS=wean* OR TS="offspring" OR TS="age factor" OR TS="age factors")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="Genomics" OR TS="Proteomics" OR TS="Metabolic Profile" OR TS="Metabolome" OR TS="Metabolomics" OR TS="Microarray" OR TS="Nanoarray")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="Gene expression" OR TS="Transcript expression" OR TS="transcriptomes" OR TS="transcriptome" OR TS="Phenotype" OR TS="Transcription" OR TS="Trans-act*" OR TS="transact*" OR TS="trans act*" OR TS=genetic OR TS="genetics" OR TS="genotype")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="Informatics" OR (TS="Information Science" AND TS=Medical OR TS="Systems biology" OR (TS="Biological systems" AND (TS=monit* OR TS=data OR TS=analysis))))
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="Genetic transcription" OR TS="Gene transcription" OR TS="Gene Activation" OR TS="Genetic induction" OR TS="Reverse transcription" OR TS="Transcriptional activation" OR TS="Transcription factors" OR (TS="Biosynthesis" AND (TS=RNA OR TS=DNA)) OR TS="mRNA")
	((TS="naphthalene" OR TS="albocarbon" OR TS="naphthalin" OR TS="naphthaline" OR TS="naphthene" OR TS="naphtalene" OR TS="camphor tar" OR TS="tar camphor" OR TS="white tar" OR TS="moth balls" OR TS="moth flakes" OR TS=mothballs) NOT TS="naphthalene acetic acid") AND (TS="messenger RNA" OR TS="transfer RNA" OR TS="peptide biosynthesis" OR TS="protein biosynthesis" OR TS="protein synthesis" OR TS="RT-PCR" OR TS="RTPCR" OR TS="Reverse Transcriptase Polymerase Chain Reaction" OR TS="DNA sequence")
ToxLine	
2/8/2019	@syn0+@AND+@OR+(naphthalene+albocarbon+naphthalin+naphthaline+ naphthene+naphtalene+""camphor+tar"+"tar+camphor"+"white+tar"+"moth+balls" +"moth+flakes"+mothballs+Naphtalinum+Naphthalinum+Dezodorator+ "Mighty+150"+"Mighty+RD1"+@term+@rn+91+20+3) +@and+@range+yr+2017+2019+@not+@org+pubmed
9/29/2017	@syn0+@AND+@OR+(naphthalene+albocarbon+naphthalin+naphthaline+naphthene+naphtalene +"camphor+tar"+"tar+camphor"+"white+tar"+"moth+balls"+"moth+flakes"+mothballs+Naphtalinu

Database Search Date	**Query String**
	m+Naphthalinum+Dezodorator+"Mighty+150"+"Mighty+RD1"+@term+@rn+91+20+3)+@and+@range+yr+2017+@not+@org+pubmed
01/04/2017	@syn0+@OR+(piscesqcorrection+naphthalene+albocarbon+naphthalin+naphthaline+naphthene+naphtalene+"camphor tar"+"tar camphor"+"white tar"+"moth balls"+"moth flakes"+mothballs+Naphtalinum+Naphthalinum+Dezodorator+"Mighty 150"+"Mighty RD1"+@term+@rn+91-20-3)+@and+@range+yr+2015+2017+@not+@org+pubmed+pubdart+"nih+reporter"+tscats
11/09/2015	@syn0+@OR+(piscesqcorrection+naphthalene+albocarbon+naphthalin+naphthaline+naphthene+naphtalene+"camphor tar"+"tar camphor"+"white tar"+"moth balls"+"moth flakes"+mothballs+Naphtalinum+Naphthalinum+Dezodorator+"Mighty 150"+"Mighty RD1"+@term+@rn+91-20-3)+@and+@range+yr+2014+2016+@not+@org+pubmed+pubdart+"nih+reporter"+tscats
12/16/2014	@OR+(naphthalene+albocarbon+naphthalin+naphthaline+naphthene+naphtalene+mothballs+@term+@rn+91-20-3)+@AND+@range+yr+2012+2015+@NOT+@org+pubmed+pubdart+"nih+reporter"+tscats
	@OR+("camphor+tar"+"tar+camphor"+"white+tar"+"moth+balls"+"moth+flakes")+@AND+@range+yr+2012+2015+@NOT+@org+pubmed+pubdart+"nih+reporter"+tscats
02/18/2013	@OR+(naphthalene+albocarbon+naphthalin+naphthaline+naphthene+naphtalene+mothballs+@term+@rn+91-20-3)+@NOT+@org+pubmed+pubdart+crisp+tscats
	@OR+("camphor+tar"+"tar+camphor"+"white+tar"+"moth+balls"+"moth+flakes")+@NOT+@org+pubmed+pubdart+crisp+tscats
Toxic Substances Control Act Test Submissions (TSCATS) via CDAT[a]	
01/04/2017	91-20-3 Mail Received Date Range 10/01/2015 to 01/04/2017
11/04/2015	91-20-3 Mail Received Date Range 01/01/2014 to 11/04/2015

Database Search Date	Query String
TSCATS 2[b]	
01/04/2017	91-20-3 EPA receipt date 10/01/2015 to date of search
12/16/2014	91-20-3 EPA receipt date 02/01/2013 to date of search
05/01/2013	91-20-3 date limited, 2000 to date of search
TSCATS 1[c]	
02/18/2013	@term+@rn+91-20-3+@AND+@org+tscats
TSCA section 8e/FYI recent submissions[d]	
01/04/2017	Google: 91-20-3 (8e or fyi) tsca
12/16/2014	Google: 91-20-3 (8e or fyi) tsca
05/01/2013	Google: 91-20-3 (8e or fyi) tsca

[a] CDAT (Chemical Data Access Tool); formerly available at http://java.epa.gov/oppt_chemical_search/. Information from CDAT has since been incorporated into EPA's ChemView database at https://chemview.epa.gov/chemview.

[b] TSCATS 2 was searched via the following database URL: https://catalog.data.gov/dataset/toxic-substances-control-act-test-submissions-2-0-tscats-2-0

[c] TSCATS 1 was searched via Toxline

[d] TSCA section 8e/FYI recent submissions were searched via Google

Table S3. Processes used to augment the search of core databases for naphthalene

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
Manual search of citations from	Bailey et al. (2015). "Hypothesis-based weight-of-evidence evaluation and risk assessment for naphthalene carcinogenesis." Critical Reviews in Toxicology: 1-42	12/2015	12 citations added

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
published reviews	Lewis (2012). "Naphthalene animal carcinogenicity and human relevancy: overview of industries with naphthalene-containing streams." Regulatory Toxicology and Pharmacology 62(1): 131-137	12/2015	1 citations added
	Piccirillo et al. (2012). "Preliminary evaluation of the human relevance of respiratory tumors observed in rodents exposed to naphthalene." Regulatory Toxicology and Pharmacology 62(3): 433-440.	12/2015	0 citations added
	Magee et al. (2010). "Screening-level population risk assessment of nasal tumors in the US due to naphthalene exposure." Regulatory Toxicology and Pharmacology 57(2-3): 168-180.	12/2015	0 citations added
	Rhomberg et al. (2010). "Hypothesis-based weight of evidence: a tool for evaluating and communicating uncertainties and inconsistencies in the large body of evidence in proposing a carcinogenic mode of action--naphthalene as an example." Critical Reviews in Toxicology 40(8): 671-696.	12/2015	0 citations added
Manual search of citations from national and international health agency documents	NTP (2016). Naphthalene (14th ed.). Research Triangle Park, NC: National Toxicology Program. https://ntp.niehs.nih.gov/ntp/roc/content/profiles/naphthalene.pdf	1/2017	0 citations added
	ACGIH (2001). Naphthalene. Documentation of the threshold limit values and biological exposure indices. Cincinnati, OH: American Conference of Industrial Hygienists.	5/2013	4 citations added
	ATSDR (2005). Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene. Atlanta, GA: Agency for Toxic Substances and Disease Registry.	5/2013	7 citations added
	IARC (2002). IARC Monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some traditional herbal medicines, some mycotoxins, naphthalene, and styrene [IARC Monograph]. Lyon, France.	5/2013	3 citations added

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
	http://monographs.iarc.fr/ENG/Monographs/vol82/mono82.pdf		
	NTP (2011). Naphthalene. In Report on Carcinogens, 12th Edition. National Toxicology Program.	5/2013	0 citations added
	WHO (1998). Selected non-heterocyclic polycyclic aromatic hydrocarbons. Environmental Health Criteria, 202. Geneva, Switzerland, World Health Organization.	5/2013	2 citations added
Web of Science, "forward" search[a]	Abdo et al. (2001). Toxicity and carcinogenicity study in F344 rats following 2 years of whole-body exposure to naphthalene vapors. Inhalation Toxicology 13:931-950.	1/2017 5/2013	0 citations added 0 citations added
	Dodd et al. (2012). Nasal epithelial lesions in F344 rats following a 90-day inhalation exposure to naphthalene. Inhalation Toxicology 24:70-79.	1/2017 5/2013	0 citations added 0 citations added
	Shopp et al. (1984). Naphthalene toxicity in CD-1 mice: general toxicology and immunotoxicology. Toxicological Sciences 4:406-419.	1/2017 5/2013	0 citations added 0 citations added
Web of Science, "backward" search[b]	Abdo et al. (2001). Toxicity and carcinogenicity study in F344 rats following 2 years of whole-body exposure to naphthalene vapors. Inhalation Toxicology 13:931-950.	5/2013	2 citations added
	Dodd et al. (2012). Nasal epithelial lesions in F344 rats following a 90-day inhalation exposure to naphthalene. Inhalation Toxicology 24:70-79.	5/2013	0 citations added
	Shopp et al. (1984). Naphthalene toxicity in CD-1 mice: general toxicology and immunotoxicology. Toxicological Sciences 4:406-419.	5/2013	5 citations added
References obtained during the assessment process	References that had been previously added to the HERO project page for the naphthalene assessment during the development of earlier draft materials.	3/2017	2 citations added
		1/2017	9 citations added
		12/2015	22 citations added

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
		5/2013	36 citations added
Search of Online Chemical Assessment-Related Websites	Searched a combination of CASRNs and synonyms on the following databases: American Conference of Governmental Industrial Hygienists (ACGIH): https://www.acgih.org/ American Industrial Hygiene Association (AIHA): Workplace Environmental Exposure Levels (WEELs) (https://www.tera.org/OARS/PDF_documents/OARS_WEEL_Table.pdf) Emergency Response Planning Guidelines (ERPGs) (https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Pages/default.aspx) Agency for Toxic Substances and Disease Registry (ATSDR): https://wwwn.cdc.gov/TSP/index.aspx CalEPA Office of Environmental Health Hazard Assessment (OEHHA): http://www.oehha.ca.gov/risk.html OEHHA Toxicity Criteria Database (http://www.oehha.ca.gov/tcdb/index.asp) Biomonitoring California-Priority Chemicals (https://biomonitoring.ca.gov/chemicals/priority-chemicals) Biomonitoring California-Designated Chemicals (https://biomonitoring.ca.gov/chemicals/designated-chemicals) Cal/Ecotox Database (https://ecotox.oehha.ca.gov/) OEHHA Fact Sheets (http://www.oehha.ca.gov/public_info/facts/index.html) Non-cancer health effects [reference exposure levels (RELs)] (http://www.oehha.ca.gov/air/allrels.html)	1/2017	1 citation added
		12/2015	13 citations added
		4/2012	19 citations added

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
	Cancer Potency Factors (Appendix A and B) (http://www.oehha.ca.gov/air/hot_spots/tsd052909.html) Consumer Product Safety Commission (CPSC): http://www.cpsc.gov Centre for Chemical Safety Assessment (ECETOC): http://www.ecetoc.org/publications European Chemicals Agency (ECHA): General site (http://echa.europa.eu/information-on-chemicals) Registered Substances (https://echa.europa.eu/information-on-chemicals/registered-substances) Existing Substances Regulation (ESR) (http://echa.europa.eu/information-on-chemicals/information-from-existing-substances-regulation) Environment Canada: Toxic Substances Managed Under Canadian Environmental Protection Act (http://www.ec.gc.ca/toxiques-toxics/Default.asp?lang=En&n=98E80CC6-1) Final Assessments (http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&xml=09F567A7-B1EE-1FEE-73DB-8AE6C1EB7658) Draft Assessments (http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&xml=6892C255-5597-C162-95FC-4B905320F8C9) Federal Docket: www.regulations.gov Health Canada: Health Canada Drinking Water Documents (http://www.hc-sc.gc.ca/ewh-semt/pubs/water-		

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
	eau/index-eng.php#tech_doc) Health Canada First Priority List Assessments (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/psl1-lsp1/index-eng.php) Health Canada Second Priority List Assessments (http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/psl2-lsp2/index-eng.php) International Agency for Research on Cancer (IARC): http://monographs.iarc.fr/ENG/Monographs/vol101/mono101-B02-B03.pdf International Toxicity Estimates for Risk (ITER): https://iter.tera.org/ Japan Existing Chemical Data Base: http://dra4.nihs.go.jp/mhlw_data/jsp/SearchPageENG.jsp National Academies of Sciences, Engineering, and Medicine (NASEM): http://www.nap.edu/ National Cancer Institute (NCI): http://www.cancer.gov National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (Australia): Australian Inventory of Chemical Substances (AICS) (http://www.cirs-reach.com/Inventory/Australian_Inventory_of_Chemical_Substances_AICS.html) National Institute of Environmental Health Sciences (NIEHS): http://www.niehs.nih.gov/ National Institute of Occupational Safety and Health (NIOSH): All Workplace Safety & Health Topics (http://www.cdc.gov/niosh/topics/) NIOSHTIC 2 Publications Search: http://www2a.cdc.gov/nioshtic-2/ Registry of Toxic Effects of Chemical Substances		

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
	(https://www.cdc.gov/niosh/rtecs/default.html) National Institute of Technology and Evaluation Chemical Risk Information Platform (NITE-CHIRP) (Japan): http://www.safe.nite.go.jp/english/db.html National Toxicology Program (NTP): Report on Carcinogens (RoC) (https://ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html) NTP Site Search (https://ntpsearch.niehs.nih.gov/) Occupational Safety and Health Administration (OSHA): http://www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html Organisation for Economic Cooperation and Development (OECD)[c]: eChemPortal (https://www.echemportal.org/echemportal/substance-search) OECD Existing Chemicals Database (https://hpvchemicals.oecd.org/ui/Search.aspx) U.S. Environmental Protection Agency (EPA): Acute Exposure Guideline Levels (https://www.epa.gov/aegl/access-acute-exposure-guideline-levels-aegls-values#chemicals) Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/) National Service Center for Environmental Publications (NSCEP) (https://www.epa.gov/nscep) RfD/RfC and Carcinogen Risk Assessment Verification Endeavor (CRAVE) meeting notes Science Inventory (http://cfpub.epa.gov/si/) High Production Volume Information System (HPVIS)		

System Used	Selected Reference(s) or Sources	Date	Additional References Identified
	(https://ofmpub.epa.gov/oppthpv/metadata.html) Chemical Data Access Tool (formerly available at http://java.epa.gov/oppt_chemical_search/; information from CDAT has been incorporated into EPA's ChemView database at https://chemview.epa.gov/chemview) Office of Pesticide Programs (http://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1) U.S. Food and Drug Administration (FDA): http://www.fda.gov/ National Center for Toxicological Research (NCTR) (http://www.fda.gov/AboutFDA/CentersOffices/OC/OfficeofScientificandMedicalPrograms/NCTR/default.htm)		

[a] "Forward" search for records that cite included studies

[b] "Backward" search for records cited by included studies

[c] Searched for OECD High Production Volume (HPV) chemicals, Screening Information Dataset (SIDS) International Uniform Chemicals Information Database (IUCLID), and SIDS United Nations Environment Programme (UNEP)

Table S4. Electronic screening inclusion terms for naphthalene (listed alphabetically by organ/health system)

Category	Terms			
Organ/Health System Specific Terms				
Cardiovascular	angio	blood AND vessel	endotheli	thrombus
	aort	capillar	heart	valve
	arrhythm	cardiac, cardio, cardium	hypertens	vascular, vaso
	artery, arteri	circulat	infarct	vein, venous
	blood AND pressure	coronary	myocardi	ventricle
Dermal/ Integumentary system	blister	epiderm, epidermal	nail	sweat, perspiration
	bulla, bullous	erythema	pruritus	tooth, teeth
	cutaneous	hair	sebaceous	
	dermal, dermis	keratin, kerato	skin	
Developmental	abnormalit	fetal, fetus, foetal, foetus	parturition	terato
	abort	gestation	perinatal	uterus, uterine
	cleft	implantation	postnatal	viable, viabil
	congenital	malform	puberty	visceral
	defect	neonat	pregnan	wean
	development	newborn	prenatal	zygote
	embryo	neural AND tube	resorption	

Category	Terms			
Organ/Health System Specific Terms				
Endocrine	adipokine	hypothalamus	pituitary	thyro
	adipocyt	insulin	triiodo	
	adrenal	pancreas, pancreat	tetraiodo	
	hormone	pineal	thymus, thymic	
Gastrointestinal	abdomen	constipation	gastrointestinal	peptic
	anus, anal	diarrhea	ileum, ileal, ileus	rectum, rectal
	bucca	digestive	intestin	salivary
	bowel	duoden	jejunum, jejunal	stomach
	cecum, cecal	esophagus	mouth	tongue
	colon	gastric	oral AND cavity	
Hematologic	albumin	cytopenia	histamine	RBC (red blood cell)
	anemia, anemic, anaemia, anaemic	erythro	hypoxemi	reticulocyt
	blood	hemoly, haemoly	granulocyt	serum
	cholesterol	hemat	plasma	thrombo
	clot	hemocoagulat	platelet	
	coagulat	hemoglobin	polycythemia	

Category	Terms			
Organ/Health System Specific Terms				
Hepatic	alkaline AND phosphatase	cholesta	glutamyltransferase	liver
	aminotransferase	cholangio	hepat	peroxisome
	bile, biliary	cirrho	hydropic	portal, periportal
	bilirubin	gall AND bladder	Ito	steatosis
	centrilobular	glycogen	Kuppfer	stellate
Immune	adenopath	complement	inflamm	monocyt
	allerg	dendrocyt, dendritic	interferon	natural AND killer
	anaphyla	eosinophil, eosinopenia	leukocyt	neutrophil, neutropenia
	antibod	epitope	lymph	phagocyt
	antigen	globulin	macrophag	polymorphonuclear
	asthma	granuloma	major histocompatibility complex, MHC	sensitize, sensitis
	basophil, basopenia	hapten	marrow	sensitivity
	B-cell	humoral	mast AND cell	spleen, splenous
	cytokine	hypersensit	macroglobulin	WBC (white blood cell)
	chemokine	immun		T-cell

Category	Terms			
Organ/Health System Specific Terms				
Musculoskeletal	articular bone bursa calcitonin	cartilage collagen connective ligament	muscle, muscul osteo pyridinoline skelet	tendon vertebra
Nervous	autonomic axon behavior, behaviour brain CNS (central nervous system) Cognitive dendrite	efferent electrophysiol encephalo fatigue FOB (functional observational battery) ganglia, ganglio	memory myelin AND sheath locomotor nerve nervous AND system neuro parasympathetic	PNS (peripheral nervous system) Ranvier Schwann sensory, sensori spinal AND cord sympathetic synap
Ocular	cataract cornea eye	harderian lachrymal, lacrimal lens, lenticular	ocular ophthalm retina	

Category	Terms			
Organ/Health System Specific Terms				
Reproductive	androgen	fertilit	ova, ovum	seminiferous
	breast	follicle	penis	sexual
	cervical, cervix	FSH	placenta	sperm
	coagulating AND gland	gamete	primordial	sterility
	corpora lutea, corpus luteum	gonad	progesterone	testes, testic, testis
	endometrium	infertility	prolactin	testosterone
	epididym	lacto, lacta	prostate	urogenital
	estrogen, estradiol	LH (luteinizing hormone)	reproduct	vagina
	estrus, estrous	lordosis	scrotum	vulva
	fallopian	mammar	seminal AND vesicle	
Respiratory	airway	cough	intratrach	pharyn
	alveolar	crackle	laryn	pneumon
	BAL (bronchoalveolar lavage)	diffusing AND capacity	lung	pulmonary
	bleb	dyspnea	nasal	rale
	bronch	FEV, forced AND expiratory	nose	respir
	chest	FVC, forced AND vital	olfactory	trach

Category	Terms			
Organ/Health System Specific Terms				
Urinary	alpha 2u globulin	creatinine	kidney	urethra
	anion AND gap	dilation, dilatation	nephro	uria
	BUN	genitourinary	proximal AND tubule, distal AND tubule	urinalysis
	bladder	glomerul	renal	urinary
	Bowman's	Henle		urine

3. Study evaluation methods

Table S5. Questions to guide the development of criteria for each domain in epidemiology studies

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
Exposure measurement Does the exposure measure reliably distinguish between levels of exposure in a time window considered most relevant for a causal effect with respect to the development of the outcome?	For all: • Does the exposure measure capture the variability in exposure among the participants, considering intensity, frequency, and duration of exposure? • Does the exposure measure reflect a relevant time window? If not, can the relationship between measures in this time and the relevant time window be estimated reliably? • Was the exposure measurement likely to be affected by a knowledge of the outcome? • Was the exposure measurement likely to be affected by the presence of the outcome (i.e., reverse causality)?	Is the degree of exposure misclassification likely to vary by exposure level? If the correlation between exposure measurements is *moderate*, is there an adequate statistical approach to ameliorate variability in measurements? If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)?	These considerations require customization to the exposure and outcome (relevant timing of exposure) **Good** • Valid exposure assessment methods used, which represent the etiologically relevant time period of interest. • Exposure misclassification is expected to be minimal. **Adequate** • Valid exposure assessment methods used, which represent the etiologically relevant time period of interest. • Exposure misclassification may exist but is not expected to greatly change the effect estimate.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Exposure measurement</u> Does the exposure measure reliably distinguish between levels of exposure in a time window considered most relevant for a causal effect with respect to the development of the outcome? (continued)	For case-control studies of occupational exposures: • Is exposure based on a comprehensive job history describing tasks, setting, time period, and use of specific materials? For biomarkers of exposure, general population: • Is a standard assay used? What are the intra- and interassay coefficients of variation? Is the assay likely to be affected by contamination? Are values less than the limit of detection dealt with adequately? • What exposure time period is reflected by the biomarker? If the half-life is short, what is the correlation between serial measurements of exposure?	Is the degree of exposure misclassification likely to vary by exposure level? If the correlation between exposure measurements is *moderate*, is there an adequate statistical approach to ameliorate variability in measurements? If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)? (continued)	**Deficient** • Valid exposure assessment methods used, which represent the etiologically relevant time period of interest. Specific knowledge about the exposure and outcome raise concerns about reverse causality, but there is uncertainty whether it is influencing the effect estimate. • Exposed groups are expected to contain a notable proportion of unexposed or minimally exposed individuals, the method did not capture important temporal or spatial variation, or there is other evidence of exposure misclassification that would be expected to notably change the effect estimate. **Critically deficient** • Exposure measurement does not characterize the etiologically relevant time period of exposure or is not valid. • There is evidence that reverse causality is very likely to account for the observed association. • Exposure measurement was not independent of outcome status.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Outcome ascertainment</u> Does the outcome measure reliably distinguish the presence or absence (or degree of severity) of the outcome?	For all: • Is outcome ascertainment likely to be affected by knowledge of, or presence of, exposure (e.g., consider access to health care, if based on self-reported history of diagnosis)? For case-control studies: • Is the comparison group without the outcome (e.g., controls in a case-control study) based on objective criteria with little or no likelihood of inclusion of people with the disease? For mortality measures: • How well does cause of death data reflect occurrence of the disease in an individual? How well do mortality data reflect incidence of the disease? For diagnosis of disease measures: • Is the diagnosis based on standard clinical criteria? If it is based on self-report of the diagnosis, what is the validity of this measure? For laboratory-based measures (e.g., hormone levels): • Is a standard assay used? Does the assay have an acceptable level of interassay variability? Is the sensitivity of the assay appropriate for the outcome measure in this study population?	Is there a concern that any outcome misclassification is nondifferential, differential, or both? What is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)?	These considerations require customization to the outcome. **Good** • High certainty in the outcome definition (i.e., specificity and sensitivity), minimal concerns with respect to misclassification. • Assessment instrument was validated in a population comparable to the one from which the study group was selected. **Adequate** • *Moderate* confidence that outcome definition was specific and sensitive, some uncertainty with respect to misclassification but not expected to greatly change the effect estimate. • Assessment instrument was validated but not necessarily in a population comparable to the study group. **Deficient** • Outcome definition was not specific or sensitive. • Uncertainty regarding validity of assessment instrument. **Critically deficient** • Invalid/insensitive marker of outcome. • Outcome ascertainment is very likely to be affected by knowledge of, or presence of, exposure. Note: Lack of blinding should not be automatically construed to be *critically deficient*.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Participant selection</u> Is there evidence that selection into or out of the study (or analysis sample) was jointly related to exposure and to outcome?	For longitudinal cohort: • Did participants volunteer for the cohort based on knowledge of exposure and/or preclinical disease symptoms? Was entry into the cohort or continuation in the cohort related to exposure and outcome? For occupational cohort: • Did entry into the cohort begin with the start of the exposure? • Was follow-up or outcome assessment incomplete, and if so, was follow-up related to both exposure and outcome status? • Could exposure produce symptoms that would result in a change in work assignment/work status ("healthy worker survivor effect")? For case-control study: • Were controls representative of population and time periods from which cases were drawn? • Are hospital controls selected from a group whose reason for admission is independent of exposure? • Could recruitment strategies, eligibility criteria, or participation rates result in differential participation relating to both disease and exposure?	Were differences in participant enrollment and follow-up evaluated to assess bias? If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)? Were appropriate analyses performed to address changing exposures over time in relation to symptoms? Is there a comparison of participants and nonparticipants to address whether differential selection is likely?	These considerations may require customization to the outcome. This could include determining what study designs effectively allow analyses of associations appropriate to the outcome measures (e.g., design to capture incident vs. prevalent cases, design to capture early pregnancy loss). **Good** • Minimal concern for selection bias based on description of recruitment process (e.g., selection of comparison population, population-based random sample selection, recruitment from sampling frame including current and previous employees). • Exclusion and inclusion criteria specified and would not induce bias. • Participation rate is reported at all steps of study (e.g., initial enrollment, follow-up, selection into analysis sample). If rate is not high, there is appropriate rationale for why it is unlikely to be related to exposure (e.g., comparison between participants and nonparticipants or other available information indicates differential selection is not likely).

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Participant selection</u> Is there evidence that selection into or out of the study (or analysis sample) was jointly related to exposure and to outcome? (continued)	For population based-survey: • Was recruitment based on advertisement to people with knowledge of exposure, outcome, and hypothesis?	Were differences in participant enrollment and follow-up evaluated to assess bias? If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)? Were appropriate analyses performed to address changing exposures over time in relation to symptoms? Is there a comparison of participants and nonparticipants to address whether differential selection is likely? (continued)	**Adequate** • Enough of a description of the recruitment process to be comfortable that there is no serious risk of bias. • Inclusion and exclusion criteria specified and would not induce bias. • Participation rate is incompletely reported but available information indicates participation is unlikely to be related to exposure. **Deficient** • Little information on recruitment process, selection strategy, sampling framework and/or participation OR aspects of these processes raises the potential for bias (e.g., healthy worker effect, survivor bias). **Critically deficient** • Aspects of the processes for recruitment, selection strategy, sampling framework, or participation result in concern that selection bias is likely to have had a large impact on effect estimates (e.g., convenience sample with no information about recruitment and selection, cases and controls are recruited from different sources with different likelihood of exposure, recruitment materials stated outcome of interest and potential participants are aware of or are concerned about specific exposures).

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes

<u>Confounding</u>
Is confounding of the effect of the exposure likely?
	Is confounding adequately addressed by considerations in:
	• Participant selection (matching or restriction)?
	• Accurate information on potential confounders and statistical adjustment procedures?
	• Lack of association between confounder and outcome, or confounder and exposure in the study?
	• Information from other sources?
	
	Is the assessment of confounders based on a thoughtful review of published literature, potential relationships (e.g., as can be gained through directed acyclic graphing), and minimizing potential overcontrol (e.g., inclusion of a variable on the pathway between exposure and outcome)?
		If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)?	These considerations require customization to the exposure and outcome, but this may be limited to identifying key covariates.
			Good
			• Conveys strategy for identifying key confounders. This may include: a priori biological considerations, published literature, causal diagrams, or statistical analyses; with recognition that not all "risk factors" are confounders.
			• Inclusion of potential confounders in statistical models not based solely on statistical significance criteria (e.g., $p < 0.05$ from stepwise regression).
			• Does not include variables in the models that are likely to be influential colliders or intermediates on the causal pathway.
			• Key confounders are evaluated appropriately and considered to be unlikely sources of substantial confounding. This often will include:
			  ○ Presenting the distribution of potential confounders by levels of the exposure of interest and/or the outcomes of interest (with amount of missing data noted);
			  ○ Consideration that potential confounders were rare among the study population, or were expected to be poorly correlated with exposure of interest;
			  ○ Consideration of the most relevant functional forms of potential confounders;
			  ○ Examination of the potential impact of measurement error or missing data on confounder adjustment;
			  ○ Presenting a progression of model results with adjustments for different potential confounders, if warranted.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes

<u>Confounding</u>
Is confounding of the effect of the exposure likely? (continued)
	Is confounding adequately addressed by considerations in:
	• Participant selection (matching or restriction)?
	• Accurate information on potential confounders and statistical adjustment procedures?
	• Lack of association between confounder and outcome, or confounder and exposure in the study?
	• Information from other sources?
	
	Is the assessment of confounders based on a thoughtful review of published literature, potential relationships (e.g., as can be gained through directed acyclic graphing), and minimizing potential overcontrol (e.g., inclusion of a variable on the pathway between exposure and outcome)? (continued)
		If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)? (continued)	**Adequate**
			Similar to *good* but may not have included all key confounders, or less detail may be available on the evaluation of confounders (e.g., subbullets in *good*). It is possible that residual confounding could explain part of the observed effect, but concern is minimal.
			
			Deficient
			• Does not include variables in the models that are likely to be influential colliders or intermediates on the causal pathway.
			• And any of the following:
			  ○ The potential for bias to explain some of the results is high based on an inability to rule out residual confounding, such as a lack of demonstration that key confounders of the exposure-outcome relationships were considered;
			  ○ Descriptive information on key confounders (e.g., their relationship relative to the outcomes and exposure levels) are not presented; or
			  ○ Strategy of evaluating confounding is unclear or is not recommended (e.g., only based on statistical significance criteria or stepwise regression [forward or backward elimination]).
			
			Critically deficient
			• Includes variables in the models that are colliders and/or intermediates in the causal pathway, indicating that substantial bias is likely from this adjustment; or
			• Confounding is likely present and not accounted for, indicating that all of the results were most likely due to bias.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
Analysis Does the analysis strategy and presentation convey the necessary familiarity with the data and assumptions?	• Are missing outcome, exposure, and covariate data recognized, and if necessary, accounted for in the analysis? • Does the analysis appropriately consider variable distributions and modeling assumptions? • Does the analysis appropriately consider subgroups of interest (e.g., based on variability in exposure level or duration or susceptibility)? • Is an appropriate analysis used for the study design? • Is effect modification considered, based on considerations developed a priori?	If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)?	These considerations may require customization to the outcome. This could include the optimal characterization of the outcome variable and ideal statistical test (e.g., Cox regression). **Good** • Use of an optimal characterization of the outcome variable. • Quantitative results presented (effect estimates and confidence limits or variability in estimates; i.e., not presented only as a *p*-value or "significant"/"not significant"). • Descriptive information about outcome and exposure provided (where applicable). • Amount of missing data noted and addressed appropriately (discussion of selection issues—missing at random vs. differential). • Where applicable, for exposure, includes LOD (and percentage below the LOD), and decision to use log transformation. • Includes analyses that address robustness of findings, e.g., examination of exposure-response (explicit consideration of nonlinear possibilities, quadratic, spline, or threshold/ceiling effects included, when feasible); relevant sensitivity analyses; effect modification examined based only on a priori rationale with sufficient numbers. • No deficiencies in analysis evident. Discussion of some details may be absent (e.g., examination of outliers).

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Analysis</u> Does the analysis strategy and presentation convey the necessary familiarity with the data and assumptions? (continued)	• Does the study include additional analyses addressing potential biases or limitations (i.e., sensitivity analyses)?	If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)? (continued)	**Adequate** Same as *good*, except: • Descriptive information about exposure provided (where applicable) but may be incomplete; might not have discussed missing data, cutpoints, or shape of distribution. • Includes analyses that address robustness of findings (examples in *good*), but some important analyses are not performed. **Deficient** • Does not conduct analysis using optimal characterization of the outcome variable. • Descriptive information about exposure levels not provided (where applicable). • Effect estimate and *p*-value presented, without standard error or confidence interval. • Results presented as statistically "significant"/"not significant." **Critically deficient** • Results of analyses of effect modification examined without clear a priori rationale and without providing main/principal effects (e.g., presentation only of statistically significant interactions that were not hypothesis driven). • Analysis methods are not appropriate for design or data of the study.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
Selective reporting Is there reason to be concerned about selective reporting?	• Were results provided for all the primary analyses described in the methods section? • Is there appropriate justification for restricting the amount and type of results that are shown? • Are only statistically significant results presented?	If there is a concern about the potential for bias, what is the predicted direction or distortion of the bias on the effect estimate (if there is enough information)?	These considerations generally do not require customization and may have fewer than four levels. **Good** • The results reported by study authors are consistent with the primary and secondary analyses described in a registered protocol or methods paper. **Adequate** • The authors described their primary (and secondary) analyses in the methods section and results were reported for all primary analyses. **Deficient** • Concerns were raised based on previous publications, a methods paper, or a registered protocol indicating that analyses were planned or conducted that were not reported, or that hypotheses originally considered to be secondary were represented as primary in the reviewed paper. • Only subgroup analyses were reported suggesting that results for the entire group were omitted. • Only statistically significant results were reported.

Domain and core question	Prompting questions	Follow-up questions	Considerations that apply to most exposures and outcomes
<u>Sensitivity</u> Is there a concern that sensitivity of the study is not adequate to detect an effect?	• Is the exposure range adequate? • Was the appropriate population included? • Was the length of follow-up adequate? Is the time/age of outcome ascertainment optimal given the interval of exposure and the health outcome? • Are there other aspects related to risk of bias or otherwise that raise concerns about sensitivity?		These considerations may require customization to the exposure and outcome and may have fewer than four levels. Some study features that affect study sensitivity may have already been included in the other evaluation domains. Other features that have not been addressed should be included here. Some examples include: **Adequate** • The range of exposure levels provides adequate variability to evaluate primary hypotheses in study. • The population was exposed to levels expected to have an impact on response. • The study population was sensitive to the development of the outcomes of interest (e.g., ages, life stage, sex). • The timing of outcome ascertainment was appropriate given expected latency for outcome development (i.e., adequate follow-up interval). • The study was adequately powered to observe an effect. • No other concerns raised regarding study sensitivity. **Deficient** • Concerns were raised about the issues described for *good* that are expected to notably decrease the sensitivity of the study to detect associations for the outcome.

Table S6. Information relevant to evaluation domains for epidemiology studies

Domain	Types of information that may need to be collected or are important for evaluating the domain
Exposure measurement	Source(s) of exposure (e.g., consumer products, occupational, an industrial accident) and source(s) of exposure data, blinding to outcome, level of detail for job history data, when measurements were taken, type of biomarker(s), assay information, reliability data from repeat measures studies, validation studies.
Outcome ascertainment	Source of outcome (effect) measure, blinding to exposure status or level, how measured/classified, incident vs. prevalent disease, evidence from validation studies, prevalence (or distribution summary statistics for continuous measures).
Participant selection	Study design, where and when was the study conducted, and who was included? Recruitment process, exclusion and inclusion criteria, type of controls, total eligible, comparison between participants and nonparticipants (or followed and not followed), and final analysis group. Does the study include potential susceptible populations or life stages (see discussion in Section 9)?
Confounding	Background research on key confounders for specific populations or settings; participant characteristic data, by group; strategy/approach for consideration of potential confounding; strength of associations between exposure and potential confounders and between potential confounders and outcome; and degree of exposure to the confounder in the population.
Analysis	Extent (and if applicable, treatment) of missing data for exposure, outcome, and confounders; approach to modeling; classification of exposure and outcome variables (continuous vs. categorical); testing of assumptions; sample size for specific analyses; and relevant sensitivity analyses.
Sensitivity	What are the ages of participants (e.g., not too young in studies of pubertal development)? What is the length of follow-up (for outcomes with long latency periods)? Choice of referent group, the exposure range, and the level of exposure contrast between groups (i.e., the extent to which the "unexposed group" is truly unexposed, and the prevalence of exposure in the group designated as "exposed").
Selective reporting	Are results presented with adequate detail for all the endpoints and exposure measures reported in the methods section, and are they relevant to the PECO? Are results presented for the full sample as well as for specified subgroups? Were stratified analyses (effect modification) motivated by a specific hypothesis?

Table S7. Questions to guide the development of criteria for each domain in experimental animal toxicology studies

Evaluation type	Domain name – core question	Prompting questions	Basic considerations

Reporting quality	**Reporting quality**
	
	Does the study report information for evaluating the design and conduct of the study for the endpoint(s)/outcome(s) of interest?
		Does the study report the following?
		
		• **Critical information** necessary to perform study evaluation:
		  ○ Species, test article name, levels and duration of exposure, route (e.g., oral, inhalation), qualitative or quantitative results for at least one endpoint of interest
		
		• **Important information** for evaluating the study methods:
		  ○ Test animal: strain, sex, source, and general husbandry procedures
		  ○ Exposure methods: source, purity, method of administration
		  ○ Experimental design: frequency of exposure, animal age, and life stage during exposure and at endpoint/outcome evaluation
		  ○ Endpoint evaluation methods: assays or procedures used to measure the endpoints/outcomes of interest
			These considerations typically do not need to be refined by assessment teams, although in some instances the **important information** may be refined depending on the endpoints/outcomes of interest or the chemical under investigation.
			
			A judgment and rationale for this domain should be given for the study. Typically, these will not change regardless of the endpoints/outcomes investigated by the study. **In the rationale, reviewers should indicate whether the study adhered to GLP, OECD, or other testing guidelines.**
			
			• *Good*: All **critical and important information** is reported or inferable for the endpoints/outcomes of interest.
			
			• *Adequate*: All **critical information** is reported but some **important information** is missing. However, the missing information is not expected to significantly impact the study evaluation.
			
			• *Deficient*: All **critical information** is reported but **important information** is missing that is expected to significantly reduce the ability to evaluate the study.
			
			• *Critically Deficient*: Study report is missing any pieces of **critical information**. Studies that are Critically Deficient for reporting are Uninformative for the overall rating and not considered further for evidence synthesis and integration.

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Risk of bias	**Selection and performance bias**	**Allocation** Were animals assigned to experimental groups using a method that minimizes selection bias?	For each study: • Did each animal or litter have an equal chance of being assigned to any experimental group (i.e., random allocation)? • Is the allocation method described? • Aside from randomization, were any steps taken to balance variables across experimental groups during allocation?	These considerations typically do not need to be refined by assessment teams. A judgment and rationale for this domain should be given for each cohort or experiment in the study. • *Good*: Experimental groups were randomized and any specific randomization procedure was described or inferable (e.g., computer-generated scheme). *Note: Normalization is not the same as randomization (see response for Adequate).* • *Adequate*: Authors report that groups were randomized but do not describe the specific procedure used (e.g., "animals were randomized"). Alternatively, authors used a nonrandom method to control for important modifying factors across experimental groups (e.g., body-weight normalization). • *Not Reported* (interpreted as Deficient): No indication of randomization of groups or other methods (e.g., normalization) to control for important modifying factors across experimental groups. • *Critically Deficient*: Bias in the animal allocations was reported or inferable.

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations

Risk of bias	**Selection and performance bias**	**Observational bias/blinding**
		
		Did the study implement measures to reduce observational bias?
			For each endpoint/outcome or grouping of endpoints/outcomes in a study:
			• Does the study report blinding or other methods/procedures for reducing observational bias?
			• If not, did the study use a design or approach for which such procedures can be inferred?
			• What is the expected impact of failure to implement (or report implementation) of these methods/procedures on results?
				These considerations typically do not need to be refined by the assessment teams.
				
				Note: It can be useful for teams to identify highly subjective measures of endpoints/outcomes where observational bias may strongly influence results prior to performing evaluations.
				
				A judgment and rationale for this domain should be given for each endpoint/outcome or group of endpoints/outcomes investigated in the study.
				• *Good*: Measures to reduce observational bias were described (e.g., blinding to conceal treatment groups during endpoint evaluation; consensus-based evaluations of histopathology lesions).[a]
				• *Adequate*: Methods for reducing observational bias (e.g., blinding) can be inferred or were reported but described incompletely.
				• *Not Reported*: Measures to reduce observational bias were not described.
				  ○ Interpreted as Adequate: The potential concern for bias was mitigated based on the use of automated/computer-driven systems; standard laboratory kits; relatively simple, objective measures (e.g., body or tissue weight); or screening-level evaluations of histopathology.
				  ○ Interpreted as Deficient: The potential impact on the results is major (e.g., outcome measures are highly subjective).
				• *Critically Deficient*: Strong evidence for observational bias that could have impacted results.

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Risk of bias	**Confounding/variable control**	**Confounding** Are variables with the potential to confound or modify results controlled and consistent across all experimental groups?	For each study: • Are there differences across the treatment groups (e.g., co-exposures, vehicle, diet, palatability, husbandry, health status, etc.) that could bias the results? • If differences are identified, to what extent are they expected to impact the results?	These considerations may need to be refined by assessment teams, as the specific variables of concern can vary by experiment or chemical. A judgment and rationale for this domain should be given for each cohort or experiment in the study, noting when the potential for confounding is restricted to specific endpoints/outcomes. • *Good*: Outside of the exposure of interest, variables that are likely to confound or modify results appear to be controlled and consistent across experimental groups. • *Adequate*: Some concern that variables that were likely to confound or modify results were uncontrolled or inconsistent across groups, but are expected to have a minimal impact on the results. • *Deficient*: Notable concern that potentially confounding variables were uncontrolled or inconsistent across groups, and are expected to substantially impact the results. • *Critically Deficient*: Confounding variables were presumed to be uncontrolled or inconsistent across groups, and are expected to be a primary driver of the results.

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Risk of bias	**Reporting and attrition bias**	**Selective reporting and attrition** Did the study report results for all prespecified outcomes and tested animals? .	For each study: *Selective reporting bias:* • Are all results presented for endpoints/outcomes described in the methods (see note under core question)? *Attrition bias:* • Are all animals accounted for in the results? • If there are discrepancies, do authors provide an explanation (e.g., death or unscheduled sacrifice during the study)? • If omitted results and/or attrition are unexplained, what is the expected impact on the interpretation of the results?	These considerations typically do not need to be refined by assessment teams. A judgment and rationale for this domain should be given for each cohort or experiment in the study. • *Good*: Quantitative or qualitative results were reported for all prespecified outcomes (explicitly stated or inferred), exposure groups and evaluation timepoints. Data not reported in the primary article is available from supplemental material. If results omissions or animal attrition are identified, the authors provide an explanation and these are not expected to impact the interpretation of the results. • *Adequate*: Quantitative or qualitative results are reported for most prespecified outcomes (explicitly stated or inferred), exposure groups and evaluation time points. Omissions and/or attrition are not explained, but are not expected to significantly impact the interpretation of the results. • *Deficient*: Quantitative or qualitative results are missing for many prespecified outcomes (explicitly stated or inferred), exposure groups and evaluation time points and/or high animal attrition; omissions and/or attrition are not explained and may significantly impact the interpretation of the results. • *Critically Deficient*: Extensive results omission and/or animal attrition are identified and prevents comparisons of results across treatment groups.

Sensitivity	**Exposure methods sensitivity**	**Chemical administration and characterization**
		
		Did the study adequately characterize exposure to the chemical of interest and the exposure administration methods?
			For each study:
			
			• Does the study report the source and purity and/or composition (e.g., identity and percent distribution of different isomers) of the chemical? If not, can the purity and/or composition be obtained from the supplier (e.g., as reported on the website)?
			
			• Was independent analytical verification of the test article purity and composition performed?
			
			• Did the authors take steps to ensure the reported exposure levels were accurate?
			
			  ○ For inhalation studies: Were target concentrations confirmed using reliable analytical measurements in chamber air?
			
			  ○ For oral studies: If necessary based on consideration of chemical-specific knowledge (e.g., instability in solution; volatility) and/or exposure design (e.g., the frequency and duration of exposure), were chemical concentrations in the dosing solutions or diet analytically confirmed?
			
			• Are there concerns about the methods used to administer the chemical (e.g., inhalation chamber type, gavage volume, etc.)?
				It is essential that these criteria are considered, and potentially refined, by assessment teams, as the specific variables of concern can vary by chemical.
				
				A judgment and rationale for this domain should be given for each cohort or experiment in the study.
				
				• *Good*: Chemical administration and characterization is complete (i.e., source, purity, and analytical verification of the test article are provided). There are no concerns about the composition, stability, or purity of the administered chemical or the specific methods of administration. For inhalation studies, chemical concentrations in the exposure chambers are verified using reliable analytical methods.
				
				• *Adequate*: Some uncertainties in the chemical administration and characterization are identified but these are expected to have minimal impact on interpretation of the results (e.g., source and vendor-reported purity are presented, but not independently verified; purity of the test article is suboptimal but not concerning; for inhalation studies, actual exposure concentrations are missing or verified with less reliable methods).
				
				• *Deficient*: Uncertainties in the exposure characterization are identified and expected to substantially impact the results (e.g., source of the test article is not reported; levels of impurities are substantial or concerning; deficient administration methods, such as the use of static inhalation chambers or a gavage volume considered too large for the species and/or life stage at exposure).
				
				• *Critically Deficient*: Uncertainties in the exposure characterization are identified and there is reasonable certainty that the results are largely attributable to factors other than exposure to the chemical of interest (e.g., identified impurities are expected to be a primary driver of the results).

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Sensitivity	**Exposure methods sensitivity**	**Exposure timing, frequency and duration** Was the timing, frequency, and duration of exposure sensitive for the endpoint(s)/ outcome(s) of interest?	For each endpoint/outcome or grouping of endpoints/outcomes in a study: • Does the exposure period include the critical window of sensitivity? • Was the duration and frequency of exposure sensitive for detecting the endpoint of interest?	Considerations for this domain are highly variable depending on the endpoint(s)/outcome(s) of interest and must be refined by assessment teams. A judgment and rationale for this domain should be given for each endpoint/outcome or group of endpoints/outcomes investigated in the study. • *Good*: The duration and frequency of the exposure was sensitive and the exposure included the critical window of sensitivity (if known). • *Adequate*: The duration and frequency of the exposure was sensitive and the exposure covered most of the critical window of sensitivity (if known). • *Deficient*: The duration and/or frequency of the exposure is not sensitive and did not include most of the critical window of sensitivity (if known). These limitations are expected to bias the results towards the null. • *Critically Deficient*: The exposure design was not sensitive and is expected to strongly bias the results towards the null. The rationale should indicate the specific concern(s).

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Sensitivity	**Outcome measures and results display**	**Endpoint sensitivity and specificity** Are the procedures sensitive and specific for evaluating the endpoint(s)/ outcome(s) of interest? *Note: Sample size alone is not a reason to conclude an individual study is critically deficient.*	For each endpoint/outcome or grouping of endpoints/outcomes in a study: • Are there concerns regarding the specificity and validity of the protocols? • Are there serious concerns regarding the sample size (see note)? • Are there concerns regarding the timing of the endpoint assessment?	Considerations for this domain are highly variable depending on the endpoint(s)/outcome(s) of interest and must be refined by assessment teams. A judgment and rationale for this domain should be given for each endpoint/outcome or group of endpoints/outcomes investigated in the study. Examples of potential concerns include: • Selection of protocols that are insensitive or nonspecific for the endpoint of interest • Use of unreliable methods to assess the outcome • Assessment of endpoints at inappropriate or insensitive ages, or without addressing known endpoint variation (e.g., due to circadian rhythms, estrous cyclicity, etc.). • Decreased specificity or sensitivity of the response due to the timing of endpoint evaluation, as compared to exposure (e.g., short-acting depressant or irritant effects of chemicals; insensitivity due to prolonged period of nonexposure before testing).

Evaluation type		Domain name -- core question	Prompting questions	Basic considerations
Sensitivity	**Outcome measures and results display**	**Results presentation** Are the results presented in a way that makes the data usable and transparent?	For each endpoint/outcome or grouping of endpoints/outcomes in a study: • Does the level of detail allow for an informed interpretation of the results? • Are the data analyzed, compared, or presented in a way that is inappropriate or misleading?	Considerations for this domain are highly variable depending on the outcomes of interest and must be refined by assessment teams. A judgment and rationale for this domain should be given for each endpoint/outcome or group of endpoints/outcomes investigated in the study. Examples of potential concerns include: • Nonpreferred presentation, such as developmental toxicity data averaged across pups in a treatment group, when litter responses are more appropriate • Failing to present quantitative results • Pooling data when responses are known or expected to differ substantially (e.g., across sexes or ages) • Failing to report on or address overt toxicity when exposure levels are known or expected to be highly toxic • Lack of full presentation of the data (e.g., presentation of mean without variance data; concurrent control data are not presented)

Evaluation type	Domain name -- core question	Prompting questions	Basic considerations
Overall confidence	**Overall confidence** Considering the identified strengths and limitations, what is the overall confidence rating for the endpoint(s)/ outcome(s) of interest?	For each endpoint/outcome or grouping of endpoints/outcomes in a study: • Were concerns (i.e., limitations or uncertainties) related to the reporting quality, risk of bias, or sensitivity identified? • If yes, what is their expected impact on the overall interpretation of the reliability and validity of the study results, including (when possible) interpretations of impacts on the magnitude or direction of the reported effects?	The overall confidence rating considers the likely impact of the noted concerns (i.e., limitations or uncertainties) in reporting, bias, and sensitivity on the results. A confidence rating and rationale should be given for each endpoint/outcome or group of endpoints/outcomes investigated in the study. • *High Confidence*: No notable concerns are identified (e.g. most or all domains rated Good). • *Medium Confidence*: Some concerns are identified, but expected to have minimal impact on the interpretation of the results (e.g., most domains rated Adequate or Good; may include studies with Deficient ratings if concerns are not expected to strongly impact the magnitude or direction of the results). Any important concerns should be carried forward to evidence synthesis. • *Low Confidence*: Identified concerns are expected to significantly impact on the study results or their interpretation (e.g., generally, Deficient ratings for one or more domains). The concerns leading to this confidence judgment must be carried forward to evidence synthesis (see note). • *Uninformative*: Serious flaw(s) that make the study results unusable for informing hazard identification (e.g., generally, a Critically Deficient rating in any domain; many Deficient ratings). Uninformative studies are not considered further in the synthesis and integration of evidence.

4. Epidemiology studies reporting on other health systems

Table S8. Summary of eight human studies that did not report any of the health systems selected for further evaluation. These studies did not undergo study evaluation.

Author/year	Study description	Route of exposure	Exposure measurement	Outcome(s) evaluated	Outcomes(s) observed	Applicability of exposure data for dose-response
Neurological						
Heaton et al. (2017)	Occupational cohort study of 74 military Air Force personnel in United States	Inhalation	Breathing zone air samples and urinary biomarkers of naphthalene exposure (1N or 2N)	Neurocognitive performance measured using a standardized battery of tests	No significant associations with neurocognitive performance for both those individuals having regular contact vs. minimal/no direct contact and between repeated measures of absorbed dose and reduced proficiency on neurocognitive tasks	**Limited suitability.** Average 4-day breathing zone exposure levels are used as surrogate indicators of high or low exposure.
Hepatic						
Sodeinde et al. (1995)	General population case-control study of 194 jaundiced neonates and 80 of	Non-specific route of exposure	Serum biomarkers of naphthalene exposure (1N or 2N)	Clinically diagnosed jaundice	No significant difference in the frequency of detection of serum	**Not suitable.** Exposure levels in control and jaundice

	their mothers (case) and 48 non-jaundiced neonates and 7 of their mothers (control) in Nigeria				naphthols between jaundiced and non-jaundiced groups	groups are reported only as ranges.
Familusi and Dawodu (1985)	General population cross-sectional health survey of 450 mothers and babies (excluding premature infants) in Nigeria	Non-specific route of exposure	Self-reported use of naphthalene-containing products	Self-reported history of neonatal jaundice. The severity of jaundice was defined as "mild" if blood transfusion was not needed and "severe" if blood transfusion was needed.	Severe jaundice associated with history of naphthalene exposure	**Not suitable.** No exposure level data. Cross-sectional study design with limited ability to assess temporality.
Endocrine/Exocrine						
Meeker et al. (2006)	General population cross-sectional health survey of 322 adult men (mean age 36.1 years) from year 2000-2003 in United States	Non-specific route of exposure	Urinary biomarker of naphthalene exposure (1N)	Serum thyroid hormone levels: free thyroxine, total triiodothyronine, and thyroid stimulating hormone	No significant associations with serum thyroid hormone levels	**Limited suitability.** Cross-sectional study design with limited ability to assess temporality. Significant concern for exposure misclassification due to use of urinary 1N. Also, insufficient availability of data or models to relate urinary metabolites to exposure levels.
Zhu et al. (2009)	General population cross-sectional health survey of 480 men diagnosed with	Non-specific route of exposure	Urinary biomarkers of naphthalene exposure	Serum thyroid hormone levels: free and total thyroxine, free triiodothyronine,	No significant associations with serum thyroid hormone levels	**Limited suitability.** Cross-sectional study design with limited ability to

	unexplained male factor infertility between 2004 and 2007 (200 controls) in China		(1N or 2N)	and thyroid stimulating hormone		assess temporality. Insufficient availability of data or models to relate urinary metabolites to exposure levels
Cardiometabolic						
Bushnik et al. (2020)	Cross-sectional analysis of data from 3667 children aged 3–18 years (excluding 551 due to missing values for at least one metabolites, 21 due to missing values for one of the outcomes, and 206 due to missing values for at least one of the covariates) who participated in the Canadian Health Measures Survey (CHMS, 2009–2015, from the second (2009–2011), third (2012–2013), and fourth (2014–2015) cycles of the CHMS)	Non-specific route of exposure	Urinary naphthalene metabolite levels (sum of 1N and 2N)	BMI (Body mass index), WC (Waist circumference), and WHtR (Waist-to-height ratio)	Statistically significant positive association of BMI, WC, and WHtR with naphthalene metabolites in the total population aged 3–18 and in age groups 6–11 and 12–18; only in age group 3-5 no statistically significant association of BMI with naphthalene	**Limited suitability.** Insufficient availability of data or models to relate urinary metabolites to exposure levels.
Scinicariello and Buser (2014)	Cross-sectional analysis of 3189 individuals 6- 19 yrs	Non-specific	Urinary biomarkers of	Body mass index (BMI) z-score, waist	Positive association between 2-napthol or total naphthalene	**Limited suitability.** Cross-sectional study design with

	old from 2001-2006 NHANES in United States	route of exposure	naphthalene exposure (1N or 2N)	circumference, rate of obesity	metabolites and BMI, waist circumference, and obesity	limited ability to assess temporality. Insufficient availability of data or models to relate urinary metabolites to exposure levels
Ranjbar et al. (2015)	Cross-sectional analysis of 4765 adult participants ≥ 20 years old from 2001-2008 NHANES in United States	Non-specific route of exposure	Urinary biomarkers of naphthalene exposure (1N or 2N)	Obesity, hypertension, dyslipidemia, type 2 diabetes, metabolic syndrome (defined as having at least 3 risk factors including high cholesterol levels, high triglyceride levels, hypertension, or blood glucose abnormalities)	Significant positive association with hypertension (2-naphthol), obesity (2-napthol), metabolic syndrome (2-napthol), dyslipidemia (1- and 2-napthol), type 2 diabetes (1- and 2-napthol). Significant negative association of 1-napthol with obesity.	**Limited suitability.** Cross-sectional study design with limited ability to assess temporality. Insufficient availability of data or models to relate urinary metabolites to exposure levels
Clark et al. (2012)	Cross-sectional analysis of 3,219 people ≥ 20 years of age, from the NHANES 2001-2004 dataset in United States	Non-specific route of exposure	Urinary biomarkers of naphthalene exposure (1N or 2N)	Serum biomarkers of cardiovascular disease (homocysteine, fibrinogen, white blood cell counts)	No significant association with serum biomarkers of cardiovascular disease	**Limited suitability.** Cross-sectional study design with limited ability to assess temporality. Insufficient availability of data or models to relate urinary metabolites to exposure levels

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Appendix: Reference Values Identified for Naphthalene

Table A1. Details on derivation of the available health effect reference values for inhalation exposure to naphthalene (from Figure 1 of the main text) (continued on following pages)

	Reference Value Name	Duration	Reference Value (mg/m^3)	Reference Value (ppm)	Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
Emergency Response	**PAC-3**	1 hour	2,600	500	Adopted previous IDLH	--	--	NIOSH (1994)	--	Adopted previous IDLH	Final (DOE, 2018)
	PAC-2	1 hour	430	83	Based on PAC-3	--	--	--	--	Based on PAC-3[b]	
	PAC-1	1 hour	79	15	Adopted NIOSH REL-STEL	--	--	--	--	Adopted NIOSH REL-STEL	

	Reference Value Name	Duration	Reference Vaue		Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
			(mg/m^3)	(ppm)							
Occupational	**NIOSH REL (TWA)**	10-hour TWA	50	10	NR	NR	NR		NR		Final (NIOSH, 1994)
	NIOSH REL-STEL	15 minutes	75	15	NR	NR	NR		NR		
	NIOSH IDLH	30 minutes	1,300	250	Acute oral toxicity	NR	NR	Gerarde (1960)	NR	Route-to-route extrapolation applied	
	ACGIH TLV-TWA [Skin][c]	8-hour TWA	52	10	Eye irritation at 15 ppm, acute hemolysis, and hepatoxicity in humans	NR	NR	Robbins (1951) Hanssler (1964) Grigor et al. (1966); Irle (1964); Naiman and Kosoy (1964); Valaes et al. (1963); Dawson et al. (1958); Cock (1957); Schafer (1951)	NR		Final (ACGIH, 2001)
	ACGIH TLV-STEL [Skin][d]	15 minutes	79	15							
	OSHA PEL (TWA)[e]	8-hour TWA	50	10	NR	NR	NR		NR		Final (OSHA, 2019)
	Cal-OSHA PEL (TWA)	8-hour TWA	0.5	0.1	NR	NR	NR		NR		

	Reference Value Name	Duration	Reference Vaue		Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
			(mg/m^3)	(ppm)							
General Public	**U.S. EPA Chronic RfC (IRIS)[f]**	Chronic	0.003	0.0006	Hyperplasia in the respiratory epithelium and metaplasia in the olfactory epithelium of adult male and female mice	10 ppm 9.3 mg/m^3 9.3 mg/m^3	LOAEL $LOAEL_{ADJ}$ $LOAEL_{HEC}$	NTP (1992)	Total UF = 3,000 UF_A = 10 UF_H = 10 UF_L = 10 UF_{DB} = 3	Duration adjusted: (6-h/24-h) × (5-d/7-d) HEC Adjusted[g]	Final (U.S. EPA, 1998)
	ATSDR MRL	Chronic (>1 year)	0.0036	0.0007	Nonneoplastic lesions in nasal olfactory epithelium and respiratory epithelium of adult male and female rats and mice	10 ppm 1.8 ppm 0.2 ppm	LOAEL $LOAEL_{ADJ}$ $LOAEL_{HEC}$	Abdo et al. (2001); NTP (2000, 1992)	Total UF = 300 UF_A = 3 UF_H = 10 UF_L = 10	Duration adjusted: (6-h/24-h) × (5-d/7-d) HEC Adjusted[h]	Final (ATSDR, 2005)
	OEHHA REL[i]	Chronic	0.009	0.002	Nasal inflammation, olfactory epithelial metaplasia, and respiratory epithelial hyperplasia in adult male and female mice	10 ppm 1.8 ppm	LOAEL $LOAEL_{ADJ}$	NTP (1992)	Total UF = 1,000 UF_A = 10 UF_H = 10 UF_L = 10 UF_S = 1	Duration adjusted: (6-h/24-h) × (5-d/7-d)	Final (OEHHA, 2000)
	MDH HBV	Acute (1 hour)	0.2	0.038	Respiratory cell swelling and sloughing in rats and nausea, vomiting, abdominal pain, and hemolytic anemia in humans	204 mg/m^3	NOAEL	Buckpitt and Richieri (1984)	Total UF = 1,000 UF_A = 10 UF_H = 10 UF_{DB} = 10		Final (MDH, 2004)

	Reference Value Name	Duration	Reference Vaue		Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
			(mg/m^3)	(ppm)							
		Chronic (1 year)	0.009	0.002	Nasal effects in adult rats and mice	10 ppm 9.3 mg/m^3	LOAEL LOAEL$_{ADJ}$	NTP (2000, 1992)	Total UF = 1,000 UF$_A$ = 10 UF$_H$ = 10 UF$_L$ = 10	Duration adjusted: (6-h/24-h) × (5-d/7-d)	
	RIVM TCA	Chronic	0.025	0.0048	Local toxic effect on the nasal mucous membrane in adult rats exposed for 28 days	5 mg/m^3	LOAEL	Coombs (1993)	Total UF = 200 UF$_A$ = 10 UF$_H$ = 10 UF$_L$ = 2	No time extrapolation Based on EU Risk Assessment: (ECB, 2003)	Final (Dusseldorp et al., 2011)
	Health Canada Residential Indoor RfC	Chronic	0.01	0.0019	Nasal epithelial cytotoxicity in adult rats	52 mg/m^3 9.3 mg/m^3	LOAEL LOAEL$_{ADJ}$	NTP (2000)	Total UF = 1,000 UF$_A$ = 10 UF$_H$ = 10 UF$_{DB}$ = 10	Duration adjusted: (6-h/24-h) × (5-d/7-d)	Final (Health Canada, 2013)
General Public (Other State Values)	**RI DEM AAL**	24 hours	0.003	0.0006	Adopted IRIS RfC as 24-hr. AAL	--	--	--	--	Adopted IRIS RfC as 24-hr. AAL	Final (RI DEM, 2008)
		1 year	0.00003	0.0000056	Cancer	0.000034 (µg/m^3)$^{-1}$	OEHHA Cancer URF	OEHHA (2011)	NA	Calculated[j]	
	OR DEQ ABC	1 year	0.00003	0.0000056	Cancer	0.000034 (µg/m^3)$^{-1}$	OEHHA Cancer URF	OEHHA (2011)	NA	Calculated[k]	Final (Oregon DEQ, 2018)
	CT DEEP HLV	30 minutes	5	1	NR	NR	NR		NR	NA	Final (CT DEEP, 2015)
		8 hours	1	0.2	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF = 50	Details reported to NATICH	
	NDEP BCL	Chronic (Cancer)	0.0000826	0.000016	Cancer	0.000034 (µg/m^3)$^{-1}$	OEHHA Cancer URF	OEHHA (2011)	NA	Calculated[l]	Final (NDEP, 2017)

AAL = Acceptable Ambient Level; ABC = Ambient Benchmark Concentration; ACGIH = American Conference of Governmental Industrial Hygienists; ADJ = adjusted; ATSDR = Agency for Toxic Substances and Disease Registry; BCL = Basic Comparison Level; Cal-OSHA = California Division of Occupational Safety and Health; CT DEEP = Connecticut Department of Energy and Environmental Protection; DOE = Department of Energy; ECB = European Chemicals Bureau; EU = European Union; HBV = Health-Based Value; HEC = human equivalent concentration; HLV = Hazard Limiting Value; IDLH = Immediately Dangerous to Life and Health; IRIS = Integrated Risk

Information System; LOAEL = lowest-observed-adverse-effect level; MDH = Minnesota Department of Health; MRL = Minimal Risk Level; NA = Not applicable; NATICH = National Air Toxics Information Clearinghouse; NDEP = Nevada Division of Environmental Protection; NIOSH = National Institute for Occupational Safety and Health; NOAEL = no-observed-adverse-effect level; NR = Not reported; NTP = National Toxicology Program; OEHHA = California Environmental Protection Agency Office of Environmental Health Hazard Assessment; OR DEQ = Oregon Department of Environmental Quality; OSHA = Occupational Safety and Health Administration; PAC = Protective Action Criteria; PEL = Permissible Exposure Limit; REL = Recommended Exposure Limit (NIOSH) or Reference Exposure Level (OEHHA); RfC = Reference Concentration; RI DEM = Rhode Island Department of Environmental Management; RIVM = *Rijksinstituut voor Volksgezondheid en Milieu,* The Netherlands Institute for Public Health and the Environment; STEL = Short-term Exposure Limit; TCA = Tolerable Concentration; TLV = Threshold Limit Value; TWA = Time-weighted average; UF = uncertainty factor; UF_H = inter-human variability; UF_A = animal to human variability; UF_L = LOAEL to NOAEL adjustment; UF_S = subchronic to chronic adjustment; UF_{DB} = database uncertainty; URF = unit risk factor; U.S. EPA = United States Environmental Protection Agency

[a] "Uncertainty factors" refer to modifying factors and other adjustment factors used by some organizations or in older EPA assessments.
[b] PAC-2 = PAC-3 / 6 = 500 ppm / 6 = 83 ppm
[c] Support documentation states: "systemic poisoning following dermal contact and absorption of naphthalene warrants a Skin notation."
Agencies of Ontario, Quebec, Ireland, Australia, New Zealand, Austria, Belgium, Spain, and Singapore report identical values.
[d] Agencies of Quebec, Australia, New Zealand, Belgium, China, Singapore, South Korea, Spain, Sweden, and the Netherlands report identical values.
[e] Agencies of Denmark, France, Hungary, Italy, Latvia, China, Romania, South Korea, Sweden, Switzerland, the Netherlands, and Turkey report identical values.
[f] The EPA IRIS RfC has been adopted as a state value by the Texas Commission on Environmental Quality, Indiana Department of Environmental Management, Pennsylvania Department of Environmental Protection, Alaska Department of Environmental Conservation, New Jersey Department of Environmental Protection, and Michigan Department of Environment, Great Lakes & Energy.
[g] $LOAEL_{HEC} = LOAEL_{ADJ} \times RGDR = 9.3\ mg/m^3 \times 1 = 9.3\ mg/m^3$
[h] $LOAEL_{HEC} = LOAEL_{ADJ} \times RGDR = 1.8\ ppm \times 0.132 = 0.2\ ppm$
[i] The OEHHA REL value has been adopted by New York DEC
[j] $AAL = 1 / URF / 10^6 = 1 / 0.000034\ (\mu g/m^3)^{-1} / 10^6 = 0.03\ \mu g/m^3$
[k] $ABC = 1 / URF / 10^6 = 1 / 0.000034\ (\mu g/m^3)^{-1} / 10^6 = 0.03\ \mu g/m^3$
[l] $BCL = TR \times AT / (ET \times EF \times ED \times URF) = (10^{-6} \times 70\ yrs. \times 365\ days/yr. \times 24\ hrs./day) / [24\ hrs./day \times 350\ days/yr. \times 26\ yrs. \times 0.000034\ (\mu g/m^3)^{-1}] = 0.0826\ \mu g/m^3$

Table A2. Details on derivation of the available health effect reference values for oral exposure to naphthalene (from Figure 2 of the main text)

	Reference Value Name	Duration	Reference Value (mg/kg-day)	Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
General Public	**U.S. EPA RfD (IRIS)[b]**	Chronic	0.02	Decreased body wt. in adult in male rats exposed 13 weeks.	100 mg/kg-day 71 mg/kg-day	NOAEL $NOAEL_{ADJ}$	NTP (1980)	Total UF = 3,000 UF_A = 10 UF_H = 10 UF_S = 10 UF_{DB} = 3	Duration adjusted: 5-d/7-d	Final (U.S. EPA, 1998)
	U.S. EPA RfD (OPP)[c]	Acute	0.4	Neurotoxicity in adult male and female rats, such as head shaking and reduced motor activity	400 mg/kg-day	LOAEL	Reynolds (1997)	Total UF = 1,000 UF_A = 10 UF_H = 10 UF_L = 10		Final (U.S. EPA, 2018c)
		Chronic	0.1	Renal toxicity in adult male rats and decreased body weight in males and females exposed 13 weeks.	100 mg/kg-day	NOAEL	NTP (1980)	Total UF = 1,000 UF_A = 10 UF_H = 10 UF_S = 10		
	ATSDR MRL	Acute (1-14 days)	0.6	Transient clinical toxicity in pregnant rats exposed on GD 6-15	50 mg/kg-day	LOAEL	NTP (1991)	Total UF = 90 UF_A = 10 UF_H = 3 UF_L = 3		Final (ATSDR, 2005)
		Intermediate (15-365 days)	0.6							
	RIVM TDI[d]	Chronic	0.04	Decreased body wt. and increased kidney and liver wt. in laboratory animals (further details not provided)	NR	NR	Edwards et al. (1997); Gustafson et al. (1997)	NR	Based on TPHCWG approach	Final (RIVM, 2001)

ADJ = adjusted; ATSDR = Agency for Toxic Substances and Disease Registry; GD = Gestation day; IRIS = Integrated Risk Information System; LOAEL = lowest-observed-adverse-effect level; MRL = Minimal Risk Level; NOAEL = no-observed-adverse-effect level; NR = Not reported; OPP = Office of Pesticide Programs; RfD = Reference Dose; RIVM = *Rijksinstituut voor Volksgezondheid en Milieu*; TDI = Tolerable Daily Intake; TPHCWG = Total Petroleum Hydrocarbon Criteria Working Group; UF = uncertainty factor; UF_H = inter-human variability; UF_A = animal to human variability; UF_L = LOAEL to NOAEL adjustment; UF_S = subchronic to chronic adjustment; UF_{DB} = database uncertainty; U.S. EPA = U.S. Environmental Protection Agency

[a] "Uncertainty factors" refer to modifying factors and other adjustment factors used by some organizations or in older EPA assessments.
[b] The U.S. EPA IRIS RfD has been adopted by the Office of Water, Health Canada, Alaska Department of Environmental Conservation, Pennsylvania Department of Environmental Protection, Connecticut Department of Energy & Environmental Protection, Nevada Division of Environmental Protection, New York State Department of Environmental Conservation, and Texas Commission on Environmental Quality.
[c] The U.S. EPA OPP chronic RfD has been adopted as a state value by Michigan Department of Environment, Great Lakes & Energy.
[d] The RIVM TDI value applies individually to non-carcinogenic polycyclic aromatic hydrocarbons "with equivalent carbon numbers of >9-16 (i.e., anthracene, fluorene and napthalene)."

Table A3. Details on additional inhalation values based on another agency's values or lacking derivation descriptions (continued on following pages)

	Reference Value Name	Duration	Reference Value		Health Effect	Point of Departure	Qualifier	Source	Uncertainty Factors[a]	Notes on Derivation	Review Status
			(mg/m^3)	(ppm)							
Special Use	**USAPHC MEG – Critical** (MEG-C)	1 hour	1,300	250	Adopted 2009 PAC-3	--	--	DOE (2009)	--	Adopted 2009 PAC-3	Final (U.S. APHC, 2013)
	USAPHC MEG – Marginal (MEG-M)	1 hour	75	15	Adopted 2009 PAC-2	--	--		--	Adopted 2009 PAC-2	
	USAPHC MEG – Negligible (MEG-N)	1 hour	75	15	Adopted 2009 PAC-1	--	--		--	Adopted 2009 PAC-1	
		8 hours	52	10	Adopted ACGIH TLV-TWA	--	--	--	--	Adopted ACGIH TLV-TWA	
		14 days	18	3.5	Based on ACGIH TLV-TWA	--	--	--	--	Based on ACGIH TLV-TWA[b]	
		1 year	0.0021	0.0004	Based on IRIS RfC	--	--	--	--	Based on IRIS RfC[c]	
Occupational (International)	**Finland Limit Value**	15 minutes	10	2	NR	NR	NR		NR		Final (IFA, 2020)
		8-hour TWA	5	1							
	Denmark Limit Value	Short-term	100	20	NR	NR	NR		NR		
	Interdepartmental Commission MAC (Poland)	15 minutes	50	10	NR	NR	NR		NR		
		8-hour TWA	20	3.8							

	Reference Value Name[a]	Duration	Reference Value		Health Effect[b]	Point of Departure[b]	Qualifier[b]	Source	Uncertainty Factors[b]	Notes on Derivation	Review Status
			(mg/m^3)	(ppm)							
General Public (Limited Details)	**ID DEQ AAC**	24 hours	2.5	0.48	NR	NR	NR		NR		Final (Idaho DEQ, 2019)
	VT DEC HAAS	1 year	0.0003	0.000056	NR	NR	NR		NR		Final (VT ANR, 2018)
	Washington State Dept. of Ecology ASIL	1 year	0.0000294	0.0000056	NR	NR	NR		NR		Final (Washington State Legislature, 2009)
	SWCAA ASIL	24 hours	0.17	0.033	NR	NR	NR		NR	Adopted 1998 Washington State ASIL	Final (SWCAA, 2019)
	MassDEP TEL[d]	24 hours	0.01425	0.00272	NR	NR	NR		NR	Values derived in accordance with this protocol: (MassDEP, 2011)	Final (MassDEP, 2019)
	MassDEP AAL[d]	1 year	0.01425	0.00272	NR	NR	NR		NR		
	ADEQ AQG	1 hour	0.63	0.12	Based on ACGIH TLV-STEL	--	--	--	--	Based on ACGIH TLV-STEL[e]	Final (U.S. EPA, 1993)[g]
		24 hours	0.4	0.077	Based on ACGIH TLV-TWA	--	--	--	--	Based on ACGIH TLV-TWA[f]	
	Broward County ONRP AAC[h]	8 hours	0.5	0.096	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF[i] = 100		
	Pinellas County Air Pollution Control Board AAC	24 hours	0.12	0.023	NR	NR	NR		NR		

	ME DEP AAL	15 minutes	7.9	1.52	NR	NR	NR		NR		
		24 hours	0.87	0.17							
		1 year	0.014	0.0027							
	ND Dept. of Health ACG	1 hour	0.79	0.15	NR	79 mg/m^3	ACGIH TLV-STEL	ACGIH (1992)	Total UF = 100		
		8 hours	0.52	0.1	NR	52 mg/m^3	ACGIH TLV-TWA				
	NDEP AAC	8 hours	1.19	0.23	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF = 42		
	NY DEC AAL	1 year	0.167	0.032	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF = 300		
	OK Dept. of Health AAC	24 hours	50	10	NR	NR	NR		Total UF[j] = 50	Based on occupational values	
	SC DHEC AAL	24 hours	1.25	0.24	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF = 40		
	TX Air Control Board AAC	30 minutes	0.44	0.085	NR	NR	NR		NR		
		1 year	0.05	0.01							
	VA Air Pollution Control AAC	24 hours	0.87	0.17	NR	52 mg/m^3	ACGIH TLV-TWA	ACGIH (1992)	Total UF[k] = 60		
	WI DNR Bureau of Air Management AQG	24 hours	1.2	0.23	Based on ACGIH TLV-TWA	--	--		--	Based on ACGIH TLV-TWA[l]	

AAC = Acceptable Ambient Concentration; AAL = Allowable Ambient Limit; ACG = Ambient Concentration Guideline; ACGIH = American Conference of Governmental Industrial Hygienists; ADEQ = Arizona Department of Environmental Quality; AQG = Air Quality Guideline; ASIL = Acceptable Source Impact Level; HAAS = Hazardous Ambient Air Standard; ID DEQ = Idaho Department of Environmental Quality; IRIS = Integrated Risk Information System; MAC = Maximum Admissible Concentration; MassDEP = Massachusetts Department of Environmental Protection; ME DEP = Maine Department of Environmental Protection; MEG = Military Exposure Guidelines; ND = North Dakota; NDEP = Nevada Division of Environmental Protection; NR = Not reported; NY DEC = New York Department of Environmental Conservation; OK = Oklahoma; ONRP = Office of Natural Resource Protection; PAC = Protective Action Criteria; RfC = Reference Concentration ; SC DHEC = South Carolina Department of Health and Environmental Control; STEL = Short-term Exposure Limit; SWCAA = Southwest Clean Air Agency; TEL = Threshold Effects Exposure Limit; TLV = Threshold Limit Value; TWA = Time-weighted average; TX = Texas; UF = uncertainty factor; USAPHC = United States Army Public Health Center; VA = Virginia; VT DEC = Vermont Department of Environmental Conservation; WI DNR = Wisconsin Department of Natural Resources

[a] "Uncertainty factors" refer to modifying factors and other adjustment factors used by some organizations or in older EPA assessments.
[b] MEG = TLV × ($IR_{Occupational}$ / $IR_{Military}$) = 52 × (10 m^3/day / 29.2 m^3/day) = 18 mg/m^3
[c] MEG = RfC × ($IR_{General\ pop.}$ / $IR_{Military}$) = 0.003 mg/m^3 × (20 m^3/day / 29.2 m^3/day) = 0.0021 mg/m^3
[d] MassDEP TEL and AAL values apply to the sum of naphthalene and 2-methylnaphthalene.
[e] 1-hr. AQG = TLV / 120 = 79 mg/m^3 / 120 = 0.63 mg/m^3
[f] 24-hr. AQG = TLV / 126 = 52 mg/m^3 / 126 = 0.4 mg/m^3
[g] This document was compiled by the U.S. Environmental Protection Agency in 1993. Values from this document may have since been archived or updated by the state agencies which reported them.
[h] The Hillsborough Co. Environmental Protection Commission and Pinellas County Air Control Board report the same value.
[i] A factor of 100 is applied "for category A substances."
[j] A factor of 50 is applied for category B substances.
[k] A factor of 60 is applied for non-carcinogens.
[l] 24-hr. AQG = TLV × 0.024 = 52 mg/m^3 × 0.024 = 1.2 mg/m^3