1-Bromopropane: Preliminary Literature Search Strategy and List of References

A. Preliminary literature search strategy

This document identifies the data sources, search terms, and search strategies that were used to identify literature for the draft monograph on 1-bromopropane *(*CASRN 106-94-5). The literature search strategy used for 1-bromopropane involved several approaches designed to identify potentially useful information for the broad range of topics covered by a Report on Carcinogens (RoC) monograph, as listed below.

- Properties and Human Exposure (focusing on the U.S. population)
- Disposition (ADME) and Toxicokinetics
- Human Cancer Studies (if available)
- Experimental Studies of Tumors (in animals exposed to cumene)
- Mechanisms of Action
  - Genotoxicity
  - Toxicity as It Relates to Mechanisms
  - Mechanisms of Carcinogenicity

The methods for identifying the relevant literature for the draft 1-bromopropane monograph including (1) the search strategy, (2) updating the literature search, and (3) review of citations using web-based systematic review software are discussed below and illustrated in Figure 1.

1) Search strategies: Relevant literature is identified using search terms, data sources, and strategies as discussed below.

a) General data search: This search covers a broad range of general data sources (see Table 1) for information relevant to many or all of the wide range of monograph topics pertaining to 1-bromopropane.

b) Exposure-related data search: This search covers a broad range of potential sources (see Table 2) for exposure-related information and physical-chemical properties.

c) Database searches in PubMed, Scopus, and Web of Science: The majority of the primary literature used to draft the 1-bromopropane monograph was identified from searches of these three extensive databases available through the NIEHS Library. Synonyms, metabolites (both Phase I and Phase II), and the chemical class for 1-bromopropane were identified from the sources listed in Table 3 and the search terms are listed in Table 4. Information on metabolites and structurally related chemicals may be important for evaluating potential mechanisms of carcinogenicity. Initial literature searches were conducted to obtain all literature (not restricted to topic) on 1-bromopropane, its metabolites and chemical class. The searches for the four debrominated Phase I metabolites of 1-bromopropane and the relevant chemical class brought up several thousand references and thus

subsequent topic-specific searches were conducted to focus the search on identifying mechanistic information for these chemicals. See Table 4 for details on this approach and Table 5 for topic-specific search terms.

Searches for human cancer studies are somewhat unique because they involve the identification of search terms for exposure scenarios that might result in exposure of people to 1-bromopropane. The major uses of 1-bromopropane are as a cleaner/degreaser, as an adhesive for manufacture of foam cushions, and as a solvent in dry cleaning. The use of 1-bromopropane in dry cleaning is more recent, since 2006. Because the expansion in the use of 1-bromopropane has been fairly recent, epidemiologic studies of workers may not be able to evaluate potential risks for cancer, which is associated with long latency periods. Formal searches were not conducted for epidemiologic studies of dry cleaners because these workers would have most likely been exposed to other solvents such as tetrachloroethylene. Literature searches conducted using search terms for spray adhesive and degreaser industries were combined with search terms for cancer epidemiologic studies (see Tables 4 and 5).

d) QUOSA library of occupational case-control studies: A search of the QUOSA-based library of approximately 6,000 occupational case-control studies, approximately 60% of which are currently available as searchable full-text pdfs, was conducted using the synonyms "1-bromopropane," "propyl bromide," and the CASRN number (106-94-5).

e) Special topic-focused search: One of the key questions in the concept document for 1-bromopropane was whether the reported alterations in immune surveillance in rodents lead to an increased incidence of tumors. An additional literature search of the three databases was conducted to identify information on immunosuppression and chemically induced cancer using the following search terms: (cancer OR tumor OR neoplasm) AND ((immune suppression) OR (immunosuppression)) AND (skin OR dermal) AND (chemically induced). The review of these citations was limited to review articles.

f) Secondary sources: Citations identified from authoritative reviews or from primary references located by literature search, together with publications citing key papers identified using the Web of Science "Cited Reference Search," were also added.

2) Updating the literature search

The literature search will be updated approximately every three months, and prior to submitting the draft monograph for interagency review. Monthly search alerts for 1-bromopropane synonyms, metabolites, chemical class, exposure scenarios (human cancer), and topic-focused searches were created in PubMed, Scopus, and Web of Science, and the results of these searches from the closing date of the initial search will be downloaded for review.

3) Review of citations using web-based systematic review software

Citations retrieved from literature searches were uploaded to web-based systematic review software and screened using inclusion and exclusion criteria. Multi-level reviews of the literature were conducted, with initial reviews (Level 1) based on titles and abstracts only to identify citations that could be excluded and to assign the included literature to one or more monograph topics; subsequent reviews (Level 2) for literature assigned to the various monograph topics were based on full-text (i.e., PDFs) of the papers and were carried out by the writer and scientific reviewer for each monograph section. Two reviewers, at least one of whom is a member of the ORoC at NIEHS, participated at each level of review. Human cancer studies and experimental animal studies undergo Level 3 reviews to assess the quality of the studies.

Figure 1. Literature search strategy and review

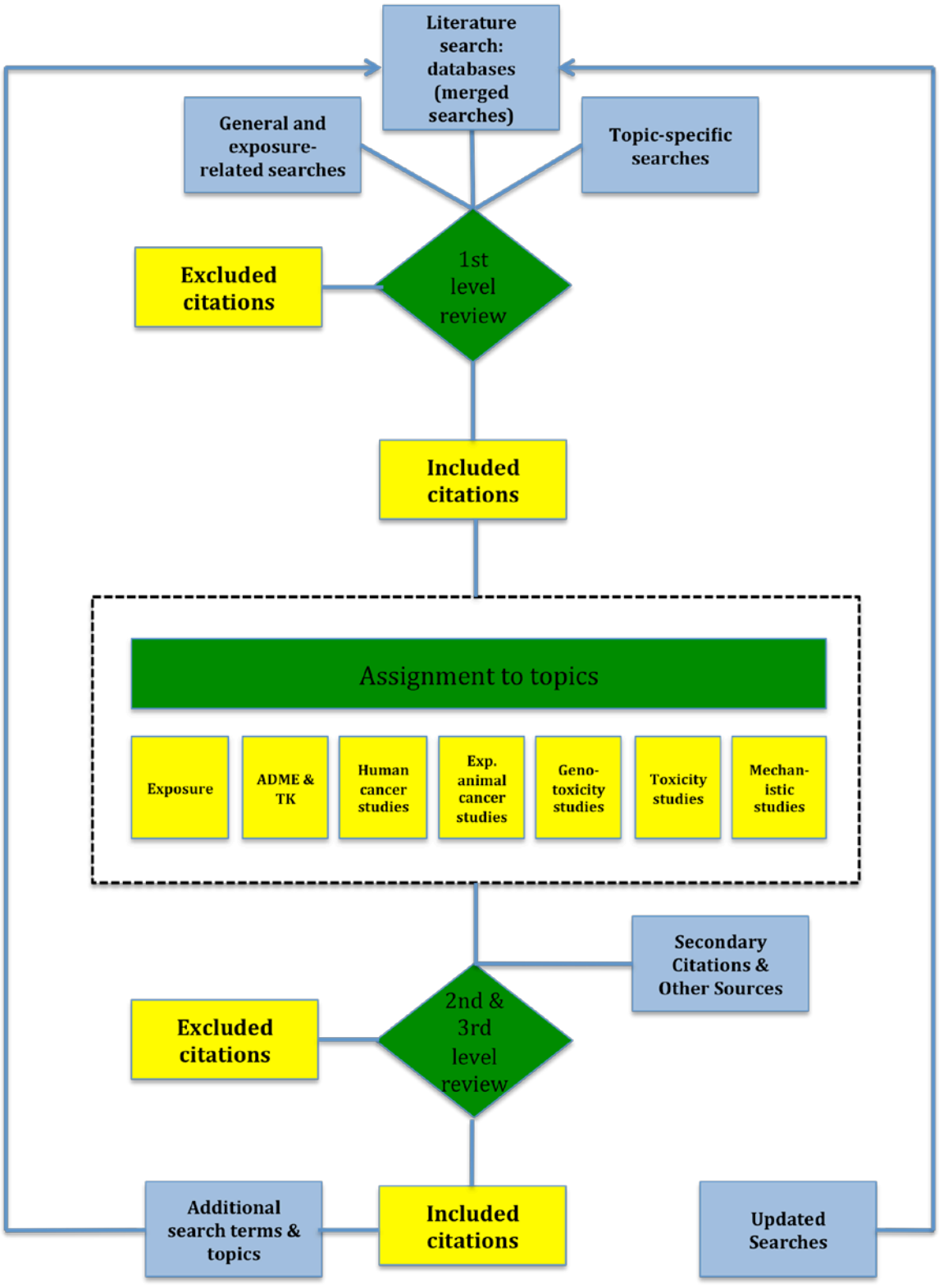

Table 1. General sources checklist for: 1-Bromopropane

Source	Name of document
A) Comprehensive sources or reviews	
1) NTP technical reports	NTP2011
2) NTP nomination for toxicological evaluation documents	NTP1999
3) OHAT (formerly CERHR)	NTP2003a (1BP) NTP2003b (2BP)
Public comments to CERHR- 10 listed on NTP website	Albemarle2001a Albemarle2001b Atofina2001 BSC2000 BSC2001a BSC2001b Envirotech2001 IRTA2001 EPA2002 Envirotech2002
4) IARC monographs	--
5) ATSDR Toxicological Profiles	--
6) EPA IRIS	--
7) NAS Reports and Publications	NAS2007 (Climate Change) NAS2008 (Review of NIOSH HHE Program)
8) WHO (IPCS) INCHEM-related documents (a-k below)	--
a) CICADS	--
b) EHC	--
c) HSGs	--
d) ICSCs	IPCS2004
e) JECFA	--
f) JMPR	--
g) KemI-Riskline	--
h) PDs	--
i) PIMS	--
j) SIDS	--
k) UKPID	--
9) California EPA Prop 65 hazard identification documents	CAEPA2004 CAEPA2008
10) Health Canada	HC2009a HC2009b
11) New York State Department of Health- Health Topics A to Z	--
B) General information sources	
1) U.S. National Library of Medicine (NLM)- TOXNET	--
a) HSDB	HSDB2006
b) CCRIS	CCRIS2008
c) GENETOX	--
d) ITER	--
e) LactMed	--
f) CPD	--
g) CTD	CTD20102

Source	Name of document
2) PubChem	PubChem2012
3) Kirk-Othmer Encyclopedia	Wypych2006 PociusCampbell2009 Suh2000
4) USGS (Minerals)	--
C) European Union– sources to search	
1) International Uniform Chemical Information Database (IUCLID)	--
2) European Chemicals Agency	--
3) The International Portal on Food Safety, Animal and Plant Health (IPFSAPH)	--
4) The European Food Safety Authority	--
5) European Centre for Disease Prevention and Control (ECDC)	--
6) European Monitoring Centre for Drugs and Drug Addiction	--
7) International Labour Organization (ILO)	ILO2005
8) United Nations Environment Programme (UNEP)	--

Table 2. Exposure-related sources checklist for: 1-Bromopropane

Source	Name of document
Exposure- and properties-specific sources	
1) U.S. National Library of Medicine (NLM)- TOXNET	--
a) ChemIDplus	ChemID2012
b) Haz-Map	HAZ-MAP2012
c) HPD	--
d) TOXMAP	--
2) Akron database	Akron2012
3) SRI Directory of Chemical Producers	SRI2012
4) Chem Sources Suppliers	ChemSources2012
5) National Health and Nutrition Examination Survey (NHANES) data studies	--
6) National Occupational Exposure Survey (NOES) (1981-1983)	--
7) National Institute for Occupational Safety and Health (NIOSH) - Health Hazard Evaluations	5 HHE: Eise-Rams2010 Harney2002 Harney2003 Reh-Nemh2001 Reh2002
8) National Response Center (NRC) Database	NRC2012a NRC2012b
9) U.S. International Trade Commission (USITC)- Import/Export data	USITC2012
10) EPA Toxics Release Inventory (TRI)	--
11) Environmental Protection Agency (EPA) AP-42, Compilation of Air Pollutant Emission Factors	--
12) EPA EJView Database	--
13) EPA High Production Volume Chemicals (HPV Challenge Program Chemical List)	--
14) EPA Inventory Update Rule (IUR)	EPA2012
15) EPA Locating and Estimating (L&E) documents	--
16) EPA/Office of Pesticide Programs (OPP) Chemical Ingredients Database	--
17) Food and Drug Administration (FDA) Pesticide Monitoring Database	--
18) FDA Orange Book	--
19) FDA Total Diet Study	--
20) Medline Plus	MedlinePlus2010
21) United States Patent Office	USPTO2011 USPTO2012a USPTO2012b
22) Trademark Electronic Search System (TESS)	--
23) Material Safety Data Sheets (MSDS)	Multiple found Sigma-Aldrich2011
24) Dow Chemical Product Safety Assessments	--

Table 3. Data sources for 1-bromopropane searches

Information type	Data sources
Synonyms	National Library of Medicine databases (e.g., ChemIDplus, Hazardous Substances Data Base)
Metabolites	Cheever *et al.* (2009), Garner *et al.* (2006), Ghanayem and Hoffler (2007), Ishidao *et al.* (2002), Jones and Walsh (1979).

Table 4: Literature search approach for 1-bromopropane

Substance	Search terms	Topics (combined with)[a]
1-Bromopropane synonyms	bromopropane, propyl bromide, and 106-94-5	None
Chemical class and synonyms	bromoalkanes, alkyl bromides, haloalkanes, alkyl halides	Animal tumors Genotoxicity Toxicity Mechanism
1-Bromopropane brominated Phase I metabolites and their synonyms	3-bromopropanol, 3-bromopropionic acid, 1-bromo-2-propanol, bromoacetone, 2-oxo-1-bromopropane, and alpha-bromohydrin	None
1-Bromopropane debrominated Phase I metabolites and their synonyms	propylene oxide, *n*-propanol, glycidol, and 3-hydroxypropionate	Animals tumors Genotoxicity Toxicity Mechanism
1-Bromopropane Phase II metabolites	1-bromo-2-hydroxypropane-*O*-glucuronide, *N*-acetyl-S-propylcysteine, *N*-acetyl-*S*-(2-hydroxypropyl)cysteine, *N*-acetyl-*S*-(3-hydroxypropyl)cysteine, *N*-acetyl-*S*-(2-carboxyethyl)cysteine, *N*-acetyl-*S*-(2-oxopropyl)cysteine, 2,3-dihydroxypropylmercapturic acid, *N*-acetyl-3-(propylsulfinyl)alanine, *N*-acetyl-3-[(2-hydroxypropyl)sulfinyl]alanine, *N*-acetyl-3-[(2-oxopropyl)sulfinyl]alanine, *N*-acetyl-3-[(2-propenol)sulfinyl]alanine	None
Exposure scenario	(Spray* AND Adhes*) or Degreas*	Human cancer studies

[a]Search terms for each of these topics were developed in consultation with an informational specialist and are listed in Table 5.

Table 5: Search terms for monograph topics for 1-bromopropane

Monograph Topic	Search terms used in PubMed, Scopus, and Web of Science	MeSH terms used in Pubmed
Human cancer studies	*Cancer search terms* - cancer* OR neoplas* OR carcinogen* OR malignan* OR oncogene* OR tumor* OR tumour* OR adenoma* OR carcinoma* OR adenocarcinoma* OR sarcoma* OR precancer* OR preneoplast* OR lesion* OR cyst* OR lymphoma* OR leukemia* OR metastas* OR cell	*Cancer search terms* - "neoplasms"[Mesh] OR "carcinogens"[Mesh] *Combine with* AND *Epidemiologic study search*

Monograph Topic	Search terms used in PubMed, Scopus, and Web of Science	MeSH terms used in Pubmed
	transform* OR cell proliferat* *Combine with* AND *Epidemiologic study search terms* - person* OR people OR individual* OR subject* OR participant* OR worker* OR employee* OR staff OR human OR woman OR women OR man OR men OR epidemiolog* OR case report* OR case control OR cohort OR case-referent OR registry OR prevalen* OR inciden*	*terms* - "epidemiology"[Subheading] OR "epidemiologic studies"[Mesh] OR "case reports"[publication type] OR "epidemiologic factors"[mh] OR "epidemiologic methods"[mh] OR "persons"[mh] OR "occupational diseases"[mh] OR "occupational exposure"[mh] OR "vital statistics"[mh]
Animal Tumors	*Cancer search terms*- cancer OR neoplasm* OR carcinogen* OR malignan* OR oncogene* OR tumor* OR tumour* *Combine with* AND *Animal study search terms*- animal* OR mouse OR mice OR rat OR hamster OR "guinea pig" OR rabbit OR monkey OR dog	*Cancer search terms*- "neoplasms"[Mesh]) OR "carcinogens"[Mesh]
Genotoxicity	*General search terms* - "genetic toxicology" OR genotoxic*[a] *Endpoint-specific search terms* - clastogen* OR "DNA strand break*" OR "unscheduled DNA synthesis" OR "UDS" OR aneuploid OR aneuploid* OR polyploid OR polyploid* OR "neoplastic cell transformation" OR "chromosom* aberration*" OR cytogenetic OR cytogenetic* OR "DNA adduct*" OR "DNA damage" OR "DNA repair" OR crosslink* OR "germ-line mutation" OR micronucle* OR mutagen OR mutagen* OR mutation OR mutation* OR oncogen* OR "sister chromatid exchange" OR "SCE" OR "SOS response*" OR "Ames test" OR "gene expression" OR "cell proliferation" OR cytotoxic OR cytotoxic* OR "comet assay"	"DNA Damage"[Mesh] OR "DNA Repair"[Mesh] OR "Mutagens"[Mesh] OR "Mutation"[Mesh] OR "Cytogenetic Analysis"[Mesh] OR "Oncogenes"[Mesh] OR "Mutagenicity Tests"[Mesh][a]
Toxicity	toxic* OR toxin*OR cytotoxic* OR (nephrotoxic* OR hepatotoxic* OR pneumotoxic* OR thyrotoxic*	"Toxic Actions"[Mesh]) OR "Toxicity Tests"[Mesh]) OR "adverse effects" [Subheading]
Mode of action	(mode* AND "of action") OR (mechanism* AND "of action") OR genetic OR epigenetic OR inhibit* OR promot* OR interact* OR activate* OR detoxific* OR "oxidative damage" OR cytotoxicity	

[a]Only the MeSH terms (or their equivalents (i.e., "genetic toxicology" OR genotoxic* OR "DNA Damage" OR "DNA Repair" OR mutagens OR mutation OR "cytogenetic analysis" OR oncogenes OR "mutagenicity tests") were used in the searches for debrominated metabolites.

B. Preliminary list of references (as of 10/05/12)

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