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Strategy for Conducting Literature Searches for Cyclic Aliphatic Bromine Cluster (HBCD): Supplemental Document to the TSCA Scope Document

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1 Overall Approach

This appendix describes EPA/OPPT's initial methods, approaches and procedures for identifying, compiling, and screening publicly available information supporting TSCA risk evaluation for Cyclic Aliphatic Bromine Cluster (HBCD). The literature searches were conducted by EPA[1] and contractor[2] staff for the following seven broad topic areas:

1. Physical/chemical properties (hereafter "pchem properties"),
2. Conditions of use of HBCD, including known, intended, and reasonably foreseen industrial, commercial, and consumer uses,
3. Fate and transport in the environment (hereafter "fate"),
4. Chemical engineering, occupational exposure and environmental releases (hereafter "engineering"),
5. General population, consumer, and ecological exposure (hereafter "exposure"),
6. Human health hazard identification and dose-response (hereafter "human health hazard"), and
7. Environmental hazard identification and concentration-response (hereafter "environmental hazard")

The following steps were generally conducted, with the exception of topic areas #1, 2 and 7:

1. Define the specific objectives of the literature search as part of the overall systematic review
2. Develop specific search strategies and execute search
3. Develop inclusion/exclusion criteria to determine which search results are "*on-topic*" versus "*off-topic*"
4. Develop topic-specific categories (or tags) to further categorize the search results
5. Screen literature search results
6. Validate the search strategy and tagging procedure (ongoing)

EPA[1] and contractors[2] worked simultaneously to conduct the literature searches and leveraged existing information, wherever possible, to facilitate the data gathering effort supporting the risk evaluation. The current process included the following:

- EPA/OPPT chemists conducted the literature searches for pchem properties (topic area #1, Section **Error! Reference source not found.**) using an approach similar to the one used in the TSCA New Chemicals Program, but not the steps described above. When applicable, the chemists relied on literature already gathered in previous EPA/OPPT assessments to support the characterization of pchem properties.

[1] EPA staff supported the literature searches for topic areas 1 and 2.

[2] ICF supported the literature searches for topic areas 3 to 6. ERG supported supplemental searches under topic area #4 to develop the life cycle diagrams. CSRA supported the literature search for ecological data under topic area #7.

- EPA/OPPT staff consulted a variety of sources to identify conditions of use (topic area #2) and to develop the *Preliminary Information on Manufacturing, Processing, Distribution, Use and Disposal for Cyclic Aliphatic Bromine Cluster (HBCD)* (hereafter "public use documents")[3]. Though the strategy did not include all the steps described above, EPA/OPPT included information reported to EPA, literature searches, trade publications, and reports developed for prior EPA and international assessments. These public use documents were used to elicit public feedback on conditions of use of the priority chemicals during and following a public meeting on February 14, 2017. Relevant public input was incorporated into this chemical's scope document.

- Searches for the fate, exposure, engineering and human health literature (topic areas #3 to 6) were conducted to (1) support the development of the initial life cycle and conceptual model diagrams, and (2) broadly capture information that would be necessary for preparing the environmental and occupational exposure and risk assessments[4]. These searches followed the steps described above.

- EPA/OPPT searched and screened the ecological literature following well accepted methods, approaches and procedures established for the ECOTOX knowledge base and used in EPA's ecological risk assessments[5] (topic area #7). In general, the process was similar to the one outlined above.

Subsequent sections describe the steps undertaken for each of these topic areas, with additional detail provided in the Appendices. Since the strategies for topic areas 3, 4, 5 and 6 (i.e., fate, engineering, exposure, and human health hazard) are similar, their strategies are in the same section.

The results of the initial search based on title and abstract screening can be found in the "*Cyclic Aliphatic Bromine Cluster (HBCD) (CASRN: 25637-99-4; 3194-55-6; 3194-57-8) Bibliography: Supplemental File for the TSCA Scope Document*". EPA/OPPT is currently evaluating the performance of the search and screening strategy (step 6) prior to commencing full-text screening. The literature search strategy may be refined and updated as the assessment progresses. Also, EPA/OPPT anticipates refinements to the literature search and screening strategy across chemicals to optimize the process for future chemicals.

2 Step 1: Define Specific Objectives for the Searches

The information needs for each topic area were developed to translate the broad regulatory mandate of TSCA into questions that could be clearly addressed with the literature search. Table 2-1 Table 2-1 provides a broad overview of the information needs for each topic area. A

[3] Initial compilation of data and/or information reported in the *Preliminary Information on Manufacturing, Processing, Distribution, Use and Disposal for Cyclic Aliphatic Bromine Cluster (HBCD)* released as part of the background materials for the public meeting on risk evaluation scoping efforts under TSCA for 10 chemical substances (Februrary 14, 2017; https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/public-meeting-risk-evaluation-scoping-efforts-under-0).

[4] Topic areas #2 and #4 complement each other.

[5] ECOTOX database: https://cfpub.epa.gov/ecotox/. EPA's Office of Pesticides (OPP) and the Office of Research and Development (ORD) frequently use ECOTOX for ecological risk assessments.

full list of information needs is provided in Appendix A for most of the topic areas. Note that general information needs for pchem properties, information on conditions of use and environmental hazard are in Table 2-1, but not in Appendix A. The ECOTOX standard operating procedures (SOPs) provide details about the information needs driving the ecological literature searches[6].

Table 2-1. Overview of Literature Search for Cyclic Aliphatic Bromine Cluster (HBCD) across All Topic Areas

Discipline	Information needs
Physical/Chemical Properties	• Collection of pchem properties to inform the fate, exposure and hazard assessments of the risk evaluation
Conditions of Use [1]	• Known, intended, and reasonably foreseen conditions of use, including manufacturing, processing, distribution, industrial, commercial and consumer uses, and disposal
Fate	• Environmental mobility • Environmental degradation • Bioaccumulation and environmental persistence • Wastewater removal processes
Engineering	• Lifecycle and process related information • Environmental releases • Occupational exposure
Exposure	• Lifecycle information to inform general population and consumer exposures • Media concentrations in the environment • Biomonitoring data • Information to identify potentially exposed and susceptible subpopulations
Human Health Hazard	• Information about health hazards including critical health effects and corresponding points of departure, associated with exposure via all routes, durations, sources, and pathways • Characterization of exposure for general and potentially exposed and susceptible subpopulations • Toxicokinetics • Mode of action (MOA) • Information to identify potentially exposed and susceptible subpopulations[2]
Environmental Hazard	• Information about environmental hazards associated with acute and chronic toxic effects on aquatic and terrestrial species

Notes:

1. The initial literature search and compilation of data and/or information are in the *Preliminary Information on Manufacturing, Processing, Distribution, Use and Disposal for Cyclic Aliphatic Bromine Cluster (HBCD)* released to the public in February 2017 as part of the background materials for the public meeting on risk evaluation scoping efforts under TSCA for 10 chemical substances (February 14, 2017; Docket ID EPA-HQ-OPPT-2016-0735 at regulations.gov and also at https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/public-meeting-risk-evaluation-scoping-efforts-under-0). Also, EPA's "Use and Market Profile for Cyclic Aliphatic Bromine Cluster (HBCD)" contains data and/or information on conditions of use in the scope document (EPA, 2017b).
2. Literature search for identifying potentially exposed and susceptible subpopulations was designed to be broad to capture information about possible susceptible subpopulations such as infants, children, pregnant women, and elderly.

[6] ECOTOX and related SOPs (https://cfpub.epa.gov/ecotox/help.cfm?helptabs=tab4)

3 Step 2: Develop Search Strategies

EPA/OPPT considered different categories of data sources when developing the search strategies:

1. Existing problem formulations, draft or final assessments completed by U.S. government agencies (e.g., EPA IRIS assessments[7]),
2. Databases containing peer-reviewed literature (e.g., PubMed, Web of Science),
3. Gray literature, which is defined as the broad category of studies not found in standard, peer-reviewed literature databases (e.g., PubMed). Gray literature includes studies that are difficult to find in conventional bibliographic databases, such as white papers, conference proceedings, technical reports, reference books, dissertations, and information on various stakeholder websites.

Table 3-1 provides an overview of the search strategies for HBCD. Additional details, including full lists of search terms and sources, are provided in Appendix B (peer reviewed literature) and Appendix C (gray literature).

Table 3-1. Overview of Search Strategies for Cyclic Aliphatic Bromine Cluster (HBCD) by Topic Area and Source Type

Discipline	Use of Existing Assessments[1]	Peer-Reviewed Literature Database Search Strategies	Gray Literature Search Strategies
Physical/ Chemical Properties	EPA/OPPT Existing Chemical Assessment	**Databases:** public databases that redirect to primary sources; see "Search Strategies for Physical/Chemical Properties" section **Date limit:** none **Key Words:** CAS Registry Number (CASRN), chemical name, and chemical structure	**Sources:** public databases; see "Search Strategies for Physical/Chemical Properties" section **Date limit:** none **Key words:** CAS Registry Number (CASRN), chemical name, and chemical structure
Conditions of Use	EPA/OPPT Existing Chemical Assessment	**Databases:** see "Search Strategies for Conditions of Use" section **Date limit:** Safety Data Sheets: 2000; see "Search Strategies for Conditions of Use" section **Key Words:** CAS Registry Number (CASRN), chemical names, synonyms, trade names, and common misspellings	**Sources:** list of resources; see "Search Strategies for Conditions of Use" section **Date limit:** none; "Search Strategies for Conditions of Use" **section for more information** **Key words:** CAS Registry Number (CASRN), chemical names, synonyms, trade names, and common misspellings
Fate, Engineering, and Exposure	EPA/OPPT Existing Chemical Assessment	**Databases:** Web of Science **Date limit:** none; search conducted February 28, 2017 **Key Words:** See Appendix A	**Sources:** Curated list of resources; see Appendix B **Date limit:** none; search conducted February 7-28, 2017

[7] Integrated Risk Information System (IRIS), https://www.epa.gov/iris

Human Health Hazard	Draft IRIS Assessment to identify literature published through January 2016; EPA/OPPT Existing Chemical Assessment	**Databases:** PubMed, Web of Science, and Toxline **Date limit**: January 1, 2016 – February 14, 2017 **Key Words**: See Appendix A	**Key words:** Varies by source; see Appendix B
Environmental Hazard	EPA/OPPT Existing Chemical Assessment	**Databases:** Science Direct, Agricola, Toxline, Scifinder, Proquest. Refer to ECOTOX SOP[2] **Date limit**: none; search conducted November 22, 2016 **Key Words**: See Appendix D	**Sources:** Curated list of resources, see Appendix D. **Date limit:** none; search conducted November 22, 2016 **Key words:** Varies by source; see Appendix D

Notes:

[1] In general, EPA/OPPT existing chemical assessments, EPA's IRIS assessments and ATSDR Toxicological Profiles were used if available. EPA/OPPT assessments may include draft or final TSCA Work Plan risk assessments and final problem formulations. When available, the EPA/OPPT assessments were used to identify pertinent references supporting pchem properties, fate and use information. In this case, EPA/OPPT considered, when pertinent, the data and/or information reported in the TSCA Work Plan Problem Formulation and Initial Assessment for HBCD (https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/assessments-tsca-work-plan-chemicals). No ATSDR Toxicological Profile has been developed for HBCD. A draft IRIS assessment for HBCD is in development but not available to the public. EPA/OPPT obtained the search strategy and search results from the IRIS program and listed the identified literature as relevant for the TSCA risk evaluation for HBCD. Peer-reviewed and gray literature search strategies were designed to supplement the search strategies of existing assessments where possible.

2 *ECOTOX Literature Searches, Citation Identification and Skimming*" (https://cfpub.epa.gov/ecotox/blackbox/help/ECOTOXLiteratureSearchesCitationIdentificationandSkimming.pdf)

3.1 Search Strategies for Physical/Chemical Properties

Most of the physical/chemical (pchem) property searches were already conducted when EPA/OPPT was preparing the TSCA Work Plan problem formulation for HBCD. The physical/chemical information pchem properties cited in the problem formulation document was retained for the scope document unless the chemist found newer studies through supplemental searches between December 2016 and March 2017.

The general approach for determining pchem properties is to first search for the specific substance in question (using CAS Registry Number (CASRN), chemical name, or the chemical structure) by following an organized path of literature and database sources, starting with public databases such as STN and REAXYS online, which links directly to the primary references. Additional searches may be conducted using resources such as ChemSpider, which provides both measured and predicted values, with limited primary references. If the exact substance cannot be found, then close structural analogs may be located and their property values extrapolated to the substance in question, or by computer estimation programs. All estimated values as well as measured ones are critically reviewed and deemed reasonable based on professional judgement. Values that are sought, as a minimum, for any physical/chemical pchem property search include: the physical state of the substance at ambient temperature (gaseous, liquid, or solid), melting point (MP) for solids, normal boiling point (BP) at 760 mmHg for liquids, vapor pressure (ideally at 25 °C), solubility in water (ideally at 25 °C) and octanol/water partition coefficient (log Kow).

3.2 Search Strategies for Conditions of Use

EPA/OPPT conducted internet searches between December 2016 and January 2017 to identify the conditions of use of HBCD, using CAS numbers, chemical names, synonyms, trade names, and common misspellings. Various sources were searched including, but not limited to, information reported to EPA (e.g., Chemical Data Reporting[8] and the Toxics Release Inventory[9]), trade publications, reports in the open literature, or citations in EPA and international assessments[10]. To identify formulated products, EPA searched for safety data sheets (SDS) using internet searches, EPA's Chemical and Product Categories (CPCat) data, the National Institute for Health's (NIH) Household Product Database, and other resources in which a SDS could be found. Each SDS was then cross-checked with company websites to make sure that each product SDS was current. The list of products was crosschecked with public data, publicly available literature, and trade publications to find known uses of HBCD. SDS dated prior to 2000 were excluded if additional sources supporting their accuracy could not be located.

The full list of data sources for conditions of use information can be found in the public use document for HBCD released as background material for the public meeting on February 14, 2017 (https://www.regulations.gov/docket?D=EPA-HQ-OPPT-2016-0735). EPA/OPPT also communicated with companies and industry groups to make sure the list of uses was correct, complete, and up-to-date. EPA/OPPT integrated into the scope document for this chemical relevant public input submitted to the docket for the public meeting (EPA-HQ-OPPT-2017-0002) and for this chemical, (EPA-HQ-OPPT-2016-0735), as well as information from other engagements with stakeholders. Summaries of the public engagement are in this chemical's docket (EPA-HQ-OPPT-2016-0735). Updated information about conditions of use were considered more current than information from the problem formulation and preferentially included in the scope document.

3.3 Search Strategies for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard

A broad search and a targeted search were conducted. The fate, engineering, exposure, and human health hazard topic areas were searched broadly to capture data and/or information that would be necessary for preparing the environmental and occupational exposure assessments. For the scope documents, a second targeted search was conducted to locate information needed to create the lifecycle diagrams and conceptual models. The first three sections below discuss the broad search, while the fourth describes the targeted lifecycle/conceptual model search.

3.3.1 Use of Existing Assessments

Where possible, EPA/OPPT used existing U.S. government assessments or summaries as a starting point for the literature searches when these assessments asked similar literature search questions to the current TSCA assessment.

[8] Chemical Data Reporting (CDR) under TSCA: https://www.epa.gov/chemical-data-reporting
[9] Toxics Release Inventory (TRI) Program: https://www.epa.gov/toxics-release-inventory-tri-program
[10] e.g., EPA/OPPT TSCA Work Plan assessments, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/assessments-tsca-work-plan-chemicals

An internal draft IRIS assessment for HBCD was used as the starting point for the human health hazard searches. The literature search for HBCD was conducted using four online scientific databases: PubMed, Toxline, Web of Science (WOS), and Toxic Substances Control Act Test Submissions (TSCATS). . The initial search was performed in August 2013, and literature search updates were conducted in June 2014, November 2014, and July 2016. The detailed search approach, including the query strings, is provided in Appendix B. This search of online databases identified 916 citations (after electronic elimination of duplicates). The search of computerized databases was supplemented by a review of other national and international health agency documents as well as "forward" and "backward" searches in WOS using four seminal references (Appendix B). The supplemental search strategies identified 68 additional citations that were obtained for full text review. A total of, 984 citations were identified using online scientific databases and supplemental search strategies.

All studies in the HERO[11] page for the final IRIS assessment were evaluated as to whether they were on-topic for human health. A supplemental literature search was conducted to identify new literature published after the IRIS assessment using the search strategy presented in Appendix B. PubMed, Web of Science, and Toxline were searched from January 1, 2016 to February 14, 2017.

Finally, EPA/OPPT conducted a problem formulation for HBCD in August 2015. All citations cited in that document were included in the current search results and automatically tagged as "*on-topic*".

3.3.2 Peer-Reviewed Literature Database Search Strategies

A professional librarian developed the database search strategies for each topic area by:

1) Considering search terms and data sources identified by EPA/OPPT's assessment team,
2) Considering strategies used for human health hazard in IRIS documents,
3) Incorporating known chemical synonyms for HBCD (see Appendix B), and
4) Tailoring terms for each database to make use of any additional details or categories available in that database (e.g., MeSH terms for the PubMed search strategy and research areas for the Web of Science search).

Relevant subject headings and text words were crafted into a search strategy that was designed to maximize the sensitivity and specificity of the search results (Appendix B). Because each database has its own search architecture, the resulting search strategy was tailored to account for each database's unique search functionality. The search strategies were executed, and EPA/OPPT is in the process of assessing their performance (see Section 6).

Literature search results were imported into EndNote® reference management software to automatically remove duplicates. Since EndNote may not remove all duplicates, additional duplicates were identified and removed manually by comparing fields (e.g., title, author, year). All of the unique references were then sent to Health & Environmental Research Online (HERO)[12], where they were assigned a unique HERO ID linked to their citation information.

[11] HERO= Health and Environmental Research Online, https://hero.epa.gov/hero/

[12] EPA/OPPT plans to use the HERO database for the draft risk evaluation, https://hero.epa.gov/hero/

3.3.3 Gray Literature Search Strategies

Automated searches were used to gather information from the gray literature using Google API (application program interface), with custom code to "scrape" (i.e., locate and download) all the targeted PDFs (e.g., NIOSH Health Hazard Evaluations). Some sites required manual searching, including databases and those with internal search functions (see Table Apx_C-2). The complete list of sites and search methods is in Appendix C.

The following data sources were considered when generating the list of websites/sources to search:

- Lists of sources identified by EPA/OPPT's assessment team,
- U.S. and International Government and Non-Government Organizations (NGOs) websites,
- Chemical/production dictionaries/encyclopedias,
- References used for the searches for conditions of use identified in EPA/OPPT's public use documents,
- State government websites covering environmental quality/management, environmental health/human health, and occupational health and safety,
- Trade Associations websites of member organizations from the National Association of Manufacturers (http://www.nam.org/Alliances/CMA/CMA-Member-Organizations/) and additional trade groups identified by the assessment team (Appendix C). Each trade group website was reviewed to identify data and/or information related to the potential uses of HBCD based on the information reported in the public use document. If the industrial sector was likely to engage in use activity identified in the public use document, the sector was included in the list of trade associations.

In general, different search terms were required for the different sources depending on the content structure of the website; all sources and search terms are documented in Appendix C. EPA/OPPT reviewed the list of sources; sites that were initially considered but removed during the search process are also listed in Appendix C. In general, these were sites requiring subscription/membership, sites that provided duplicative information, or sites that were not operational at the time of the search.

The search was performed by going to all URLs in the gray literature sources list and searching for HBCD-specific information. The search results were either PDF's or a URL describing the search result. Because each result did not have a pre-made citation that could appear in a bibliography, each search result was assigned as a specific "result ID", and the PDF was named to match that result ID.

3.3.4 Initial Lifecycle/Conceptual Model Targeted Search

Specific sources from the gray literature search were used to inform the initial lifecycle diagram and initial conceptual models; these sources were chosen based on existing SOPs and expert judgment by engineers. The sources searched are denoted in Appendix C with an asterisk. In addition, the existing draft assessment for HBCD was consulted for on-topic information. The results of the search are included in the "*Cyclic Aliphatic Bromine Cluster (HBCD) (CASRN: 25637-99-4; 3194-55-6; 3194-57-8) Bibliography: Supplemental File for the TSCA Scope Document*". As with the broad gray literature search, the search was performed by going to the URLs and searching for HBCD-specific information. The search results were either PDF's or a URL describing the search result.

3.4 Search Strategies for Environmental Hazard

For the ECOTOX database, the ecological literature was identified through comprehensive and well-documented literature searches using the ECOTOX SOPs[13]. These searches are conducted manually or electronically. Manual searches consist of skimming of reference sections of review or summary articles that are not the primary source of data, and papers that document test method procedures. Electronic searches consist of searching electronic abstracting services such as Science Direct, Agricola, Toxline, Scifinder, and Proquest. Sources and search terms are documented in Appendix D.

4 Step 3 and 4: Develop Inclusion/Exclusion Criteria and Tags to Categorize Search Results

4.1 Inclusion/Exclusion Criteria for Physical/Chemical Properties

Pchem studies were eligible for inclusion if they provided values on the exact substance. If a value for the exact substance could not be found, then a close structural analog was located and a value was extrapolated to the substance in question. If no primary data or close analog data was available, computer estimation programs were used. All estimated values as well as measured ones are critically reviewed and deemed reasonable based on professional judgement. Studies were excluded from further consideration if they had the following characteristics:

- Lack of reporting data for the pchem property of interest,
- Inadequate reporting of methodology used to measure pchem property,
- Inadequate characterization of the chemical substance of interest, including impurities.

These general criteria were used to identify relevant studies reporting the pchem properties of HBCD.

4.2 Inclusion/Exclusion Criteria for Conditions of Use

Information from sources available to EPA/OPPT, including information reported to EPA/OPPT, trade publications, internet searches, public comments, stakeholder meetings, and public databases, among others, was eligible for inclusion if it provided data or information on:

- Manufacturing, processing, distribution, use or disposal data or relevant information about this chemical,
- Trends in manufacturing (including import) volumes of this chemical,
- Number and location of sites that manufacture, process, distribute, use, recycle, or dispose of this chemical,
- Functional uses for this chemical,
- Which industry sectors use this chemical,
- What concentrations (weight fraction) of this chemical are used in industrial, commercial, and consumer applications,
- What types of products or articles contain this chemical,

[13] ECOTOX and related SOPs (https://cfpub.epa.gov/ecotox/help.cfm?helptabs=tab4)

- Methods of distribution, e.g. internet sales,
- What volume of this chemical is used for each type of use,
- Which uses have been discontinued or phased out,
- The likelihood that other chemicals will replace this chemical and the names of the other chemicals,[14]
- The likelihood that this chemical will replace other chemicals with similar functional uses,[14]
- Uses for recycled materials containing this chemical and volume of material recycled,
- Approximate number and description of individuals who can be exposed to this chemical, e.g. industrial workers, commercial workers, high-frequency consumer use, low-frequency consumer use, children,
- The typical setting for uses (e.g. outdoors, indoors, industrial commercial, residential, vehicular).

Data or information not within these characteristics were excluded for further consideration.

4.3 Inclusion/Exclusion Criteria and Tags for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard

Because the searches were designed to be broad, they necessarily returned results that are not on topic for EPA/OPPT's risk evaluations. Based on the information needs identified in Step 1, EPA/OPPT developed specific criteria to determine which references should be tagged as "on-topic" (inclusion criteria) and "off-topic" (exclusion criteria). These were created for each topic area, with gray literature having additional inclusion/exclusion criteria for each source as presented in Section 4.4. The gray literature source-specific criteria are in Appendix C. Specific inclusion/exclusion criteria were not developed for the lifecycle/conceptual model search; the search was conducted by engineers with experience developing lifecycle diagrams and conceptual models, and professional judgment was used to determine which resources were on-topic.

Additional sub-categories (or sub-tags) were also included in the tagging structure to allow for additional categorization by source type (e.g., published peer reviewed article versus government report); data type (a primary data source versus a review article or assessment document); topic area (e.g., tagging general population exposure separately from consumer exposure), and chemical-specific and use-specific data or information. These sub-categories are described in Appendix E and will be used to organize the different streams of evidence during the stages of data evaluation and integration. These steps are not reported in the scope document but will be documented in the draft risk evaluation. Although these sub-categories are discussed in this document, they are not included in the in the "*Cyclic Aliphatic Bromine Cluster (HBCD) (CASRN: 25637-99-4; 3194-55-6; 3194-57-8) Bibliography: Supplemental File for the TSCA Scope Document*" because EPA/OPPT is currently reviewing and refining the results of the categorization, including possible changes to the tagging structure.

[14] Information on alternative chemicals sometimes provides useful information for the exposure assessment.

4.4 Inclusion/Exclusion Criteria for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard Gray Literature

The gray literature includes a diverse set of sources that were searched using either a manual or automated search technique. The following overall inclusion/exclusion criteria were applied to the gray literature in conjunction with judgment based on subject matter expertise. The ecological search results were assessed using different criteria.

1. General Inclusion Criteria for Gray Literature:

    - Quantitative data retrieved from database searches
    - Documents that contain quantitative information or assessments of the chemical of interest
    - White papers, position papers, regulatory lists, and other information that summarizes how a particular government/agency prioritizes or characterizes the chemical of interest
    - Data provided to the Agency by chemical companies and other stakeholders that is publicly available,
    - Additional links within the website that link to sites within the same domain/agency
    - Information about best practices for remediating or limiting exposure to the chemical

2. General Exclusion Criteria for Gray Literature:

    - Documents not available to the public, including information stored within EPA's firewall that is not accessible on the EPA webpage (e.g., TSCA submissions), Confidential Business Information, and information requiring a paid subscription or membership for access
    - Links that were broken at the time of the search
    - Public comments (usually those without quantitative data) on documents other than the EPA/OPPT existing chemicals dockets
    - High level fact sheets and PowerPoint presentations that primarily translate scientific information for the public
    - Case studies (primarily occupational exposure) that do not have quantitative information
    - Documents that do not explicitly mention the chemical of interest
    - FR notices with no quantitative values
    - Documents that describe analytical method development but provide no actual measurements useful for characterizing exposure
    - Documents captured in searches of other sources
    - Researcher CVs and contact information
    - Documents reached via a link on the website that are from other government websites
    - Landing pages with links, when those links are also captured by the search
    - General lists of resources
    - Peer-reviewed articles – peer reviewed literature was assumed to be captured in searches of the databases of peer-reviewed literature.
    - Draft or earlier versions of documents previously captured

- Duplicate documents (same exact document found in two different result id's for the same chemical)

These criteria were applied to each gray literature resource, and that application required some judgment. Thus, Table A3.2 in Appendix C provides information specific to that source that indicates how the inclusion and exclusion criteria were interpreted and applied.

4.5 Inclusion/Exclusion Criteria and Tags for Environmental Hazard

On-topic (or applicable) ecological studies obtained through the ECOTOX literature search were required to meet specific acceptability criteria. Additionally, rejection criteria were developed and are documented through ECOTOX codes. Specific details concerning the inclusion/exclusion criteria for ecological studies are included in Appendix E.

5 Step 5: Screen Search Results

5.1 Screening and Tagging for Physical/Chemical Properties

The screening of pchem studies was conducted by an experienced chemist, who applied the inclusion/exclusion criteria when reviewing the title and abstract, and if necessary, the full text, of the studies. Following the identification of relevant studies, the chemist reviewed the quality and acceptability of the studies. The included studies are cited in Section 2.2 and Table 2-1 of the scope document. No tagging was developed or incorporated for the information on pchem properties.

5.2 Screening and Tagging for Conditions of Use

EPA/OPPT screened literature and publicly-available databases, among other sources, to identify information on this chemical's manufacturing, processing, distribution, use, and disposal. Preliminary information was included in the public use document. No tagging was done for this information on conditions of use.

5.3 Screening and Tagging for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard

5.3.1 Peer-Reviewed Literature Database Search Results

Following the database search, the references were imported into DRAGON[15], a database system used to manage aspects of the systematic review process, including literature screening, risk of bias evaluation, and data integration for screening and tagging. DRAGON was used to facilitate the title/abstract screening across a large team. DRAGON allows references to be assigned to different individuals for screening, it allows tracking of the status of screening, and it stores all of the screening decisions. DRAGON does not perform any of the screening; all screening is done manually by trained individuals.

[15] EPA/OPPT is in the process of migrating from DRAGON to Distiller for the next steps of the screening process, https://www.icf.com/solutions-and-apps/dragon-online-tool-systematic-review..

The title and abstract of each reference identified by the literature search was reviewed/screened, by a single reviewer, to determine if the study was *on-topic* or *off-topic*. On-topic references were then tagged, or categorized, using the topic area tags. All individuals who conducted the screening were trained and provided instructions and definitions of tags as shown in Appendix D. As part of the training process, a senior-level technical expert in the topic area of interest independently reviewed the appropriateness of the assigned tags for the first batch of studies reviewed by an individual screener and provided feedback to the screener. Necessary revisions or clarifications to the screening/tagging instructions and definitions were made and circulated to all screeners. Senior-level technical experts also provided feedback and guidance on specific references to the individual screeners as needed during the screening and tagging process. At the conclusion of the title and abstract review for all topic areas, all final tags applied to references were exported from DRAGON and then uploaded into the HERO database.

5.3.2 Gray Literature Search Results

Screening and tagging for the gray literature was performed using Excel to organize and tag the unique search results. Because these types of references generally do not have titles and abstracts, screening and tagging was done on the full text. For references that were searched using the Google API, up to 100 unique results were retrieved for each URL searched. All 100 were then screened to determine if they were *on-topic* or *off-topic*. For references that had to be searched manually, the screener went to each URL and screened all available information for HBCD on that site, preferentially searching by CAS number.

During a pilot phase of the broad search, each screener tagged 10 references, which were independently reviewed by the senior level technical expert. Discrepancies between the screener and the technical expert were discussed generating specific feedback to the screener before he/she continued with tagging. After the pilot phase, the remaining results were reviewed and tagged according to the tagging structure.

A targeted gray literature search was conducted and an experienced engineer screened the search results to support the development of the initial lifecycle diagram/conceptual models.

5.4 Screening and Tagging for Environmental Hazard

The ECOTOX inclusion/exclusion criteria were used to identify *on-topic* and *off-topic* ecological studies. Reviewers used codes to record the reasons for including or excluding studies. Additional details about the screening and coding procedures can be found in the document "*ECOTOX Literature Searches, Citation, Identification and Skimming",* https://cfpub.epa.gov/ecotox/blackbox/help/ECOTOXLiteratureSearchesCitationIdentificationandSkimming.pdf.

6 Step 6. Quality Assessment Procedure for Screening and Tagging

Before proceeding with systematic review and data evaluation, EPA/OPPT will assess the specificity and efficiency of the literature searches. Examples of how EPA/OPPT plans to evaluate the performance of the search strategies include:

- Comparison of the references cited in existing EPA/OPPT TSCA problem formulation document against those identified by the initial search,
- Comparison of the references cited in the public use documents and supporting the life cycle diagrams against those found by the initial search, and
- Comparison of the references cited in review articles.

EPA/OPPT will also assess the performance of the categorization (or tagging) conducted during the title/abstract screening for both the peer-reviewed and gray literature. As a result, some references may move from the *on-topic* to the *off-topic* category, and vice versa. Additional on-topic references could be identified and targeted supplemental searches may be conducted during the analysis phase (e.g., to locate specific information for exposure modeling).

APPENDICES

A. LITERATURE SEARCH INFORMATION NEEDS FOR CYCLIC ALIPHATIC BROMINE CLUSTER (HBCD)

A-1 Fate Information Needs

Table_Apx A-1. Fate Information Needs for Cyclic Aliphatic Bromine Cluster (HBCD)

Objectives	Information Needs
All Objectives	Fate and transport related pchem properties (e.g., octanol-water partition coefficient, organic carbon-water partition coefficient, Henry's Law constant), Bioaccumulation and bioconcentration, biodegradation and metabolism, abiotic degradation (e.g., hydrolysis, photolysis, abiotic reduction), Removal processes in wastewater treatment plants, and Environmental mobility

A-2 Engineering/Occupational Exposure Information Needs

Table_Apx A-2. Engineering/Occupational Exposure Information Needs for Cyclic Aliphatic Bromine Cluster (HBCD)

Objectives	Information Needs
All Objectives (including both Occupational Exposure and Environmental Releases)	Description of the life cycle of the chemical(s) of interest, from manufacture to end-of-life (e.g., each manufacturing, processing, or use step), and material flow between the industrial and commercial life cycle stages. The total annual US volume (lb/yr or kg/yr) of the chemical(s) of interest manufactured, imported, processed, and used; and the share of total annual manufacturing and import volume that is processed or used in each life cycle step. Description of processes, equipment, unit operations, and material flows and frequencies (lb/site-day or kg/site-day and days/yr; lb/site-batch and batches/yr) of the chemical(s) of interest during each industrial/ commercial life cycle step. Note: if available, include weight fractions of the chemicals (s) of interest and material flows of all associated primary chemicals (especially water).

	Basic chemical properties relevant for assessing exposures and releases, e.g., molecular weight, normal boiling point, melting point, physical forms, and room temperature vapor pressure. Number of sites that manufacture, process, or use the chemical(s) of interest for each industrial/ commercial life cycle step and site locations.
Occupational Exposures	Description of worker activities with exposure potential during the manufacture, processing, or use of the chemical(s) of interest in each industrial/commercial life cycle stage. Potential routes of exposure (e.g., inhalation, dermal). Physical form of the chemical(s) of interest for each exposure route (e.g., liquid, vapor, mist) and activity. Breathing zone (personal sample) measurements of occupational exposures to the chemical(s) of interest, measured as time-weighted averages (TWAs), short-term exposures, or peak exposures in each occupational life cycle stage (or in a workplace scenario similar to an occupational life cycle stage). Area or stationary measurements of airborne concentrations of the chemical(s) of interest in each occupational setting and life cycle stage (or in a workplace scenario similar to the life cycle stage of interest). For solids, bulk and dust particle size characterization data. Dermal exposure data. Information needs associated with mathematical modeling (will be determined on a case-by-case basis). Exposure duration. Exposure frequency. Number of workers who potentially handle or have exposure to the chemical(s) of interest in each occupational life cycle stage. Personal protective equipment (PPE) types employed by the industries within scope. Engineering controls employed to reduce occupational exposures in each occupational life cycle stage (or in a workplace scenario similar to the life cycle stage of interest), and associated data or estimates of exposure reductions
Environmental Releases	Description of sources of potential environmental releases, including cleaning of residues from process equipment and transport containers, involved during the manufacture, processing, or use of the chemical(s) of interest in each life cycle stage. Estimated mass (lb or kg) of the chemical(s) of interest released from industrial and commercial sites to each environmental medium (air, water, land) and treatment and disposal methods (publicly owned treatment works (POTW), incineration, landfill), including: o Releases per site and aggregated over all sites; o Annual release rates; o Daily release rates; o Release or emission factors; and o Number of release days per year. Information needs associated with mathematical modeling (will be determined on a case-by-case basis). Waste treatment methods and pollution control devices employed by the industries within scope and associated data on release/emission reductions.

A-3 Exposure Information Needs

Table_Apx A-3. Exposure Information Needs for Cyclic Aliphatic Bromine Cluster (HBCD)

Objectives	Information Needs
Lifecycle, general	What products contain this chemical? What articles contain this chemical?

population, and consumer exposures	How are products/articles typically disposed of? What are the use patterns/frequencies for different age groups for the products/articles? Are there existing assessments (including modeled data) looking at exposure to the general population? Are there existing assessments (including modeled data) looking at exposure to consumers? What specific activities have the potential for consumer exposures to chemicals? What are the likely routes of exposure? What are the number of consumers potentially exposed? Are any modeled exposures available?
Presence in the environment/ Biomonitoring data	Is there monitoring data for the concentration of this chemical in: o Foods, either individually or as a "market basket" o Drinking water in the United States, either from well water or public drinking water sources o Ambient Air o Indoor Air o Indoor Dust o Soil o Wastewater/sludge o Sediment o Plant life/crops/biota o Terrestrial Wildlife/livestock/fish/ aquatic wildlife o Blood (for US populations) o Urine (for US populations) o Cord blood (for US populations) o Human tissues (for US populations)
Environmental Releases	Are there documented populations near manufacturing facilities or in other hot spots receiving higher-than-average exposure? Is there chemical-specific emission rate data for the products/articles containing the chemical?

A-4 Human Health Information Needs

Table_Apx A-4. Human Health Information Needs for Cyclic Aliphatic Bromine Cluster (HBCD)

Objectives	Information Needs
Overall Objectives	• Identify and document all health hazards associated with exposure to the chemical via all relevant routes, durations and sources/pathways of exposure, using hazard data from: o Animal and human (epidemiological and experimental) studies o Acute/immediate effects, delayed acute effects, chronic/long-term effects • Identify critical health effect(s) such as acute effects, low-dose effects and/or severe effects (e.g., cancer, non-cancer target organ effects, reproductive/developmental effects) o Identify key studies for critical effect(s) o Identify dose (or concentration)-response data

	• Identify points of departures (PODs) for critical effect(s) for each relevant exposure route (e.g., inhalation, oral, dermal) and exposure duration (e.g., acute, sub chronic and chronic)
Toxicokinetics	• Identify toxicokinetic data, i.e. on absorption, distribution, metabolism, excretion (ADME): ○ Animal and human studies ○ *In vitro* studies ○ Modelled ADME data ○ Physiologically-based pharmacokinetic (PBPK) models
Mode of Action (MOA)	• Identify studies that support a MOA for critical effects e.g., for threshold or non-threshold cancer and non-cancer effects from: ○ *In vitro* mechanistic studies ○ Genotoxicity studies ○ *In vivo* mechanistic studies ○ Experimental studies in humans ○ Studies that link exposure to a carcinogenic effect
Occupational Exposures	• Characterization of health effects associated with occupational exposures: ○ Health effects associated with various exposure routes and/or physical forms of the chemical ○ For solid dusts – differences in health effects associated with particle size fraction
Potentially Exposed and Susceptible Subpopulations	• Characterization of factors that may make humans more vulnerable to develop adverse effects

B. DATABASE (PEER-REVIEWED) LITERATURE SEARCHES FOR FATE, ENGINEERING/OCCUPATIONAL EXPOSURE, EXPOSURE, AND HUMAN HEALTH HAZARD

B-1 Literature Search Strategy from the Draft Cyclic Aliphatic Bromine Cluster (HBCD) IRIS Assessment

Table_Apx B-1. Literature search query strings from the draft Cyclic Aliphatic Bromine Cluster (HBCD) IRIS Assessment

Database search date	Terms	Hits
PubMed 07/12/16	(3194-55-6[rn] OR 25637-99-4[rn] OR "1,2,5,6,9,10-hexabromocyclodecane"[tw] OR hexabromocyclododecane*[tw] OR HBCD*[tw] OR "Bromkal 73-6CD"[tw] OR "Bromkal 73-6D"[tw] OR "HBCD-LM"[tw] OR "HBCD-LMS"[tw] OR "HBCD-SP 75"[tw] OR "Myflam 11645"[tw] OR "Nicca Fi-None CG 1"[tw] OR "Nicca Fi-None TS 1"[tw] OR "Nicca Fi-None TS 3"[tw] OR "Nicca Fi-None TS 88"[tw] OR "Pyroguard F 800"[tw] OR "Pyroguard SR 103"[tw] OR "Pyroguard SR 103A"[tw] OR "Pyroguard SR 103HR"[tw] OR "Pyroguard SR 104"[tw] OR "Pyrovatex 3887"[tw] OR "Safron 5261"[tw] OR "Saytex HBCD"[tw] OR "Saytex HBCD-LM"[tw] OR "Saytex HBCD-SF"[tw] OR "Saytex HP 900"[tw] OR "Saytex HP 900G"[tw]) AND (2014/11/01:3000[mhda] OR 2014/11/01:3000[edat] OR 2014/11/01:3000[crdat])	186

11/14/14	(3194-55-6[rn] OR 25637-99-4[rn] OR "1,2,5,6,9,10-hexabromocyclodecane"[tw] OR hexabromocyclododecane*[tw] OR HBCD*[tw] OR "Bromkal 73-6CD"[tw] OR "Bromkal 73-6D"[tw] OR "HBCD-LM"[tw] OR "HBCD-LMS"[tw] OR "HBCD-SP 75"[tw] OR "Myflam 11645"[tw] OR "Nicca Fi-None CG 1"[tw] OR "Nicca Fi-None TS 1"[tw] OR "Nicca Fi-None TS 3"[tw] OR "Nicca Fi-None TS 88"[tw] OR "Pyroguard F 800"[tw] OR "Pyroguard SR 103"[tw] OR "Pyroguard SR 103A"[tw] OR "Pyroguard SR 103HR"[tw] OR "Pyroguard SR 104"[tw] OR "Pyrovatex 3887"[tw] OR "Safron 5261"[tw] OR "Saytex HBCD"[tw] OR "Saytex HBCD-LM"[tw] OR "Saytex HBCD-SF"[tw] OR "Saytex HP 900"[tw] OR "Saytex HP 900G"[tw]) AND (2014/05/01:3000[mhda] OR 2014/05/01:3000[edat] OR 2014/05/01:3000[crdat])	77
06/09/14	(3194-55-6[rn] OR 25637-99-4[rn] OR "1,2,5,6,9,10-hexabromocyclodecane"[tw] OR hexabromocyclododecane*[tw] OR HBCD*[tw] OR "Bromkal 73-6CD"[tw] OR "Bromkal 73-6D"[tw] OR "HBCD-LM"[tw] OR "HBCD-LMS"[tw] OR "HBCD-SP 75"[tw] OR "Myflam 11645"[tw] OR "Nicca Fi-None CG 1"[tw] OR "Nicca Fi-None TS 1"[tw] OR "Nicca Fi-None TS 3"[tw] OR "Nicca Fi-None TS 88"[tw] OR "Pyroguard F 800"[tw] OR "Pyroguard SR 103"[tw] OR "Pyroguard SR 103A"[tw] OR "Pyroguard SR 103HR"[tw] OR "Pyroguard SR 104"[tw] OR "Pyrovatex 3887"[tw] OR "Safron 5261"[tw] OR "Saytex HBCD"[tw] OR "Saytex HBCD-LM"[tw] OR "Saytex HBCD-SF"[tw] OR "Saytex HP 900"[tw] OR "Saytex HP 900G"[tw]) AND (2013/06/01:3000[mhda] OR 2013/06/01:3000[edat] OR 2013/06/01:3000[crdat])	115
08/20/13	hexabromocyclododecane[nm] OR "3194-55-6"[tw] OR "25637-99-4"[tw] OR "1,2,5,6,9,10-hexabromocyclodecane"[tw] OR hexabromocyclododecane*[tw] OR HBCD[tw] OR HBCDs[tw]	468
Web of Science 07/12/16	(TS="Bromkal 73-6CD" OR TS="Bromkal 73-6D" OR TS="HBCD-LM" OR TS="HBCD-LMS" OR TS="HBCD-SP 75" OR TS="Myflam 11645" OR TS="Nicca Fi-None CG 1" OR TS="Nicca Fi-None TS 1" OR TS="Nicca Fi-None TS 3" OR TS="Nicca Fi-None TS 88" OR TS="Pyroguard F 800" OR TS="Pyroguard SR 103" OR TS="Pyroguard SR 103A" OR TS="Pyroguard SR 103HR" OR TS="Pyroguard SR 104" OR TS="Pyrovatex 3887" OR TS="Safron 5261" OR TS="Saytex HBCD" OR TS="Saytex HBCD-LM" OR TS="Saytex HBCD-SF" OR TS="Saytex HP 900" OR TS="Saytex HP 900G" OR TS="1,2,5,6,9,10-hexabromocyclodecane" OR TS=hexabromocyclododecane* OR TS=HBCD*) 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	100

	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*) Limit 2014-present	
11/14/14	(TS="Bromkal 73-6CD" OR TS="Bromkal 73-6D" OR TS="HBCD-LM" OR TS="HBCD-LMS" OR TS="HBCD-SP 75" OR TS="Myflam 11645" OR TS="Nicca Fi-None CG 1" OR TS="Nicca Fi-None TS 1" OR TS="Nicca Fi-None TS 3" OR TS="Nicca Fi-None TS 88" OR TS="Pyroguard F 800" OR TS="Pyroguard SR 103" OR TS="Pyroguard SR 103A" OR TS="Pyroguard SR 103HR" OR TS="Pyroguard SR 104" OR TS="Pyrovatex 3887" OR TS="Safron 5261" OR TS="Saytex HBCD" OR TS="Saytex HBCD-LM" OR TS="Saytex HBCD-SF" OR TS="Saytex HP 900" OR TS="Saytex HP 900G" OR TS="1,2,5,6,9,10-hexabromocyclodecane" OR TS=hexabromocyclododecane* OR TS=HBCD*) 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*) Limit 2013-present	80
06/09/14	(TS="Bromkal 73-6CD" OR TS="Bromkal 73-6D" OR TS="HBCD-LM" OR TS="HBCD-LMS" OR TS="HBCD-SP 75" OR TS="Myflam 11645" OR TS="Nicca Fi-None CG 1" OR TS="Nicca Fi-None TS 1" OR TS="Nicca Fi-None TS 3" OR TS="Nicca Fi-None TS 88" OR TS="Pyroguard F 800" OR TS="Pyroguard SR 103" OR TS="Pyroguard SR 103A" OR TS="Pyroguard SR 103HR" OR TS="Pyroguard SR 104" OR TS="Pyrovatex 3887" OR TS="Safron 5261" OR TS="Saytex HBCD" OR TS="Saytex HBCD-LM" OR TS="Saytex HBCD-SF" OR TS="Saytex HP 900" OR TS="Saytex HP 900G" OR TS="1,2,5,6,9,10-hexabromocyclodecane" OR TS=hexabromocyclododecane* OR TS=HBCD*) 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	57

	& 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="HUMAN" OR TS=patient* OR TS=mother OR TS=fetal OR TS=citizens OR TS=milk OR TS=formula OR TS=diet)) OR TI=toxic*) Limit 2013 to present	
08/21/13	(TS="1,2,5,6,9,10-hexabromocyclodecane" OR TS="hexabromocyclododecane" OR TS=hexabromocyclododecane* OR TS="HBCD" OR TS="HBCDs") 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="HUMAN" OR TS=patient*)) OR TS="exposure")	326

ToxLine 07/12/16	@syn0+@or+(piscesqcorrection+hexabromocyclododecane*+HBCD*+@term+@rn+3194-55-6+@term+@rn+25637-99-4)+@and+@range+yr+2014+2016+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	0
	@syn0+@or+(piscesqcorrection+"Bromkal+73-6CD"+"Bromkal+73-6D"+"HBCD-LM"+"HBCD-LMS"+"HBCD-SP+75"+"Myflam+11645"+"Nicca+Fi-None+CG+1"+"Nicca+Fi-None+TS+1"+"Nicca+Fi-None+TS+3"+"Nicca+Fi-None+TS+88"+"Pyroguard+F+800"+"Pyroguard+SR+103"+"Pyroguard+SR+103A")+@and+@range+yr+2014+2016+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	
	@syn0+@or+(piscesqcorrection+"Pyroguard+SR+103HR"+"Pyroguard+SR+104"+"Pyrovatex+3887"+"Safron+5261"+"Saytex+HBCD"+"Saytex+HBCD+LM"+"Saytex+HBCD+SF"+"Saytex+HP+900"+"Saytex+HP+900G")+@and+@range+yr+2014+2016+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	
11/14/14	@syn0+@or+(hexabromocyclododecane*+HBCD*+@term+@rn+3194-55-6+@term+@rn+25637-99-4)+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"	0
	@syn0+@or+("Bromkal+73-6CD"+"Bromkal+73-6D"+"HBCD-LM"+"HBCD-LMS"+"HBCD-SP+75"+"Myflam+11645"+"Nicca+Fi-None+CG+1"+"Nicca+Fi-None+TS+1"+"Nicca+Fi-None+TS+3"+"Nicca+Fi-None+TS+88"+"Pyroguard+F+800"+"Pyroguard+SR+103"+"Pyroguard+SR+103A")+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	
	@syn0+@or+("Pyroguard+SR+103HR"+"Pyroguard+SR+104"+"Pyrovatex+3887"+"Safron+5261"+"Saytex+HBCD"+"Saytex+HBCD-LM"+"Saytex+HBCD-SF"+"Saytex+HP+900"+"Saytex+HP+900G")+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	
06/09/14	@syn0+@or+("1,2,5,6,9,10-hexabromocyclodecane"+hexabromocyclododecane*+HBCD*+@term+@rn+3194-55-6+@term+@rn+25637-99-4)+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"	0
	@syn0+@or+("Bromkal+73-6CD"+"Bromkal+73-6D"+"HBCD-LM"+"HBCD-LMS"+"HBCD-SP+75"+"Myflam+11645"+"Nicca+Fi-None+CG+1"+"Nicca+Fi-None+TS+1"+"Nicca+Fi-None+TS+3"+"Nicca+Fi-None+TS+88"+"Pyroguard+F+800"+"Pyroguard+SR+103"+"Pyroguard+SR+103A")+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	0
	@syn0+@or+("Pyroguard+SR+103HR"+"Pyroguard+SR+104"+"Pyrovatex+3887"+"Safron+5261"+"Saytex+HBCD"+"Saytex+HBCD-LM"+"Saytex+HBCD-SF"+"Saytex+HP+900"+"Saytex+HP+900G")+@and+@range+yr+2013+2014+@not+@org+pubmed+pubdart+"nih+reporter"+tscats	0
08/22/13	@OR+(@term+@rn+25637-99-4+@term+@rn+3194-55-6)+@NOT+@org+pubmed+pubdart+"nih+reporter"+tscats	22
	@OR+("hexabromocyclodecane"+"hexabromocyclododecane"+"hexabromocyclododecane"+"hexabromocyclododecanes"+"HBCD"+"HBCDs")+@NOT+@org+pubmed+pubdart+"nih+reporter"+tscats	20
TSCATS 1 07/12/16	@or+(@term+@rn+25637-99-4+@term+@rn+3194-55-6)+@and+@range+yr+2014+2016+@and+@org+tscats	0
11/14/14	@or+(@term+@rn+25637-99-4+@term+@rn+3194-55-6)+@and+@range+yr+2013+2014+@and+@org+tscats	0
06/09/14	@or+(@term+@rn+25637-99-4+@term+@rn+3194-55-6)+@and+@range+yr+2013+2014+@and+@org+tscats	0
08/22/13	@term+@rn+25637-99-4+@AND+@org+tscats	12
	@term+@rn+3194-55-6+@and+@org+tscats	53
TSCATS 2 07/12/16	https://java.epa.gov/oppt_chemical_search/ date limited, 11/01/2014-date of search	0
11/14/14	3194-55-6, 25637-99-4 date limited, 2014-date of search	0
06/06/14	3194-55-6, 25637-99-4	0

	date limited, 2013-date of search	
08/22/13	3194-55-6, 25637-99-4 date limited, 2000-date of search	10
TSCA 8e/FYI recent submissions 07/12/16	Google: 3194-55-6 25637-99-4 (8e OR fyi) tsca	0
11/14/14	Google: 3194-55-6 25637-99-4 (8e OR fyi) tsca	0
06/06/14	Google: 3194-55-6 25637-99-4 (8e OR fyi) tsca	0
08/22/13	Google: 3194-55-6 25637-99-4 (8e OR fyi) tsca	4
Combined reference set	(duplicates eliminated through electronic screen)	916

Table_Apx B-2. Processes used in the Draft Cyclic Aliphatic Bromine Cluster (HBCD) IRIS Assessment to Augment the Search of Core Computerized Databases for HBCD

System used	Selected key reference(s) or sources	Date	Additional references identified
Manual search of citations from health assessment documents	EINECS (2008). Risk assessment: Hexabromocyclododecane. CAS-No.: 25637-99-4. Final report. Luxembourg: European Inventory of Existing Commercial Chemical Substances, Office for Official Publications of the European Communities	9/2013	7 citations added
	Environment Canada (2011). Screening Assessment Report on Hexabromocyclododecane; Chemical Abstracts Service Registry Number 3194-55-6, Environment Canada, Health Canada	9/2013	0 citations added
WOS, forward search	Ema et al. (2008). Two-generation reproductive toxicity study of the flame retardant hexabromocyclododecane in rats. Reprod Toxicol 25: 335-351. http://dx.doi.org/10.1016/j.reprotox.2007.12.004	9/2013	0 citations added
	Eriksson et al. (2006). Impaired behaviour, learning and memory, in adult mice neonatally exposed to hexabromocyclododecane (HBCDD). Environ Toxicol Pharmacol 21: 317-322. http://dx.doi.org/10.1016/j.etap.2005.10.001	9/2013	0 citations added
	Saegusa et al. (2009). Developmental toxicity of brominated flame retardants, tetrabromobisphenol A and 1,2,5,6,9,10-hexabromocyclododecane, in rat offspring after maternal exposure from mid-gestation through lactation. Reprod Toxicol 28: 456-467. http://dx.doi.org/10.1016/j.reprotox.2009.06.011	9/2013	0 citations added
	van der Ven et al. (2009). Endocrine effects of hexabromocyclododecane (HBCD) in a one-generation reproduction study in Wistar rats. Toxicol Lett 185: 51-62. http://dx.doi.org/10.1016/j.toxlet.2008.12.003	9/2013	0 citations added
WOS, backward search	Ema et al. (2008). Two-generation reproductive toxicity study of the flame retardant hexabromocyclododecane in rats. Reprod Toxicol 25: 335-351. http://dx.doi.org/10.1016/j.reprotox.2007.12.004	9/2013	2 citations added
	Eriksson et al. (2006). Impaired behaviour, learning and memory, in adult mice neonatally exposed to	9/2013	1 citation added

	hexabromocyclododecane (HBCD). Environ Toxicol Pharmacol 21: 317-322. http://dx.doi.org/10.1016/j.etap.2005.10.001		
	Saegusa et al. (2009). Developmental toxicity of brominated flame retardants, tetrabromobisphenol A and 1,2,5,6,9,10-hexabromocyclododecane, in rat offspring after maternal exposure from mid-gestation through lactation. Reprod Toxicol 28: 456-467. http://dx.doi.org/10.1016/j.reprotox.2009.06.011	9/2013	0 citations added
	van der Ven et al. (2009). Endocrine effects of hexabromocyclododecane (HBCD) in a one-generation reproduction study in Wistar rats. Toxicol Lett 185: 51-62. http://dx.doi.org/10.1016/j.toxlet.2008.12.003	9/2013	0 citations added
References obtained during the assessment process	Snowball search	9/2013, Ongoing	42 citations added
Search of online chemical assessment-related websites	Combination of CASRNs and synonyms searched on the following websites: ACGIH (http://www.acgih.org/home.htm) AIHA WEELs (http://www.tera.org/OARS/WEEL.html) ATSDR (http://www.atsdr.cdc.gov/substances/index.asp) CalEPA Office of Environmental Health Hazard Assessment (http://www.oehha.ca.gov/risk.html) OEHHA Toxicity Criteria Database (http://www.oehha.ca.gov/tcdb/index.asp) Biomonitoring California-Priority Chemicals (http://www.oehha.ca.gov/multimedia/biomon/pdf/PriorityChemsCurrent.pdf) Biomonitoring California-Designated Chemicals (http://www.oehha.ca.gov/multimedia/biomon/pdf/DesignatedChemCurrent.pdf) Cal/Ecotox Database (http://www.oehha.ca.gov/scripts/cal_ecotox/CHEMLIST.ASP) CalEPA Drinking Water Notification Levels (http://www.swrcb.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.shtml) OEHHA Fact Sheets (http://www.oehha.ca.gov/public_info/facts/index.html) Non-cancer health effects Table (RELs) (http://www.oehha.ca.gov/air/allrels.html) and Cancer Potency Factors (Appendix A and AppendixB) (http://www.oehha.ca.gov/air/hot_spots/tsd052909.html) CHRIP (http://www.safe.nite.go.jp/english/db.html) CPSC (http://www.cpsc.gov) ECETOC publications (http://www.ecetoc.org/publications) ECHA General site (http://echa.europa.eu/information-on-chemicals) ECHA info on Registered Substances (http://echa.europa.eu/information-on-chemicals/registered-substances) ECHA Information from the Existing Substances Regulation (ESR) (http://echa.europa.eu/information-on-chemicals/information-from-existing-substances-regulation) eChemPortal (participating databases: ACToR, AGRITOX, CCR, CCR DATA, CESAR, CHRIP, ECHA CHEM, EnviChem, ESIS, GHS-J, HPVIS, HSDB, HSNO CCID, INCHEM, J-CHECK, JECDB, NICNAS	7/13/2016	4 citations added
		11/14/2014	1 citation added
		6/9/2014	1 citation added
		8/26/2013	10 citations added

	PEC, OECD HPV, OECD SIDS IUCLID, SIDS UNEP, UK CCRMP Outputs, US EPA IRIS, US EPA SRS) (http://www.echemportal.org/echemportal/participant/page.action?pageID=9) Environment Canada – Search entire site (http://www.ec.gc.ca/default.asp?lang=En&n=ECD35C36) if not found below: Toxic Substances Managed Under CEPA (http://www.ec.gc.ca/toxiques-toxics/Default.asp?lang=En&n=98E80CC6-1) Search results 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) EPA CDAT (http://java.epa.gov/oppt_chemical_search/) EPA Acute Exposure Guideline Levels (http://www.epa.gov/oppt/aegl/pubs/chemlist.htm) EPA NSCEP (http://www.epa.gov/ncepihom/) EPA OPP (http://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1) EPA Science Inventory (http://cfpub.epa.gov/si/) ERPGs (https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Pages/default.aspx) FDA (http://www.fda.gov/) Federal Docket (www.regulations.gov) Health Canada – Search entire site (http://www.hc-sc.gc.ca/index-eng.php) Health Canada Drinking Water Documents (http://www.hc-sc.gc.ca/ewh-semt/pubs/water-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) IARC Index: (http://monographs.iarc.fr/ENG/Monographs/vol101/mono101-B02-B03.pdf) IRISTrack/New Assessments and Reviews (http://cfpub.epa.gov/ncea/iris/search/) Japan Existing Chemical Data Base (JECDB) (http://dra4.nihs.go.jp/mhlw_data/jsp/SearchPageENG.jsp) NAP – Search Site (http://www.nap.edu/) NCI (http://www.cancer.gov) National Center for Toxicological Research (http://www.fda.gov/AboutFDA/CentersOffices/OC/OfficeofScientificandMedicalPrograms/NCTR/default.htm) NICNAS (PEC only covered by eChemPortal) (http://www.nicnas.gov.au/industry/aics/search.asp) NIEHS (http://www.niehs.nih.gov/) NIOSH (http://www.cdc.gov/niosh/topics/) NIOSHTIC 2 (http://www2a.cdc.gov/nioshtic-2/) NTP - RoC, status, results, and management reports		

	12th Report On Carcinogens: (http://ntp.niehs.nih.gov/?objectid=03C9AF75-E1BF-FF40-DBA9EC0928DF8B15) 13th Report On Carcinogens: (http://ntp.niehs.nih.gov/?objectid=03C9AF75-E1BF-FF40-DBA9EC0928DF8B15) NTP Site Search: (http://ntpsearch.niehs.nih.gov/texis/search/?query=arsenic&pr=ntp_web_entire_site_all&mu=Entire+NTP+Site) OECD HPV/SIDS/IUCLID (cross-check with eChem) (http://webnet.oecd.org/hpv/ui/Search.aspx) OSHA (http://www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html) RTECS (http://www.ccohs.ca/search.html) UNEP SIDS (through 2007) (http://www.chem.unep.ch/irptc/sids/OECDSIDS/sidspub.html)		

ACGIH = American Conference of Governmental Industrial Hygienists; ACToR = Aggregated Computational Toxicology Resource; AIHA = American Industrial Hygiene Association; ATSDR = Agency for Toxic Substances and Disease Registry; CalEPA = California Environmental Protection Agency; CASRN = Chemical Abstracts Service Registry Number; CCID = Chemical Classification Information Database; CCR = Canadian Categorization Results; CCRMP = Coordinated Chemicals Risk Management Programme Publications; CDAT = Chemical Data Access Tool; CEPA = Canadian Environmental Protection Act; CESAR = Canada's Existing Substances Assessment Repository; CHRIP = Chemical Risk Information Platform; CPSC = Consumer Product Safety Commission; ECETOC = European Centre for Ecotoxicology and Toxicology of Chemicals; ECHA = European Chemicals Agency; EnviChem = Data Bank of Environmental Properties of Chemicals; EPA = Environmental Protection Agency; ERPG = Emergency Response Planning Guidelines; ESIS = European chemical Substances Information System; FDA = Food and Drug Administration; GHS-J = Globally Harmonized System-Japan; HPV = High Production Volume; HPVIS = High Production Volume Information System; HSDB = Hazardous Substances Data Bank; HSNO = Hazardous Substances and New Organisms; IARC = International Agency for Research on Cancer; IRIS = Integrated Risk Information System; IUCLID = International Uniform Chemical Information Database; J-CHECK = Japan CHEmicals Collaborative Knowledge; JECDB = Japan Existing Chemical Data Base; NAP = National Academies Press; NAS = National Academy of Sciences; NCI = National Cancer Institute; NICNAS = National Industrial Chemicals Notification and Assessment Scheme; NIEHS = National Institute for Environmental Health Sciences; NIOSH = National Institute for Occupational Safety and Health; NIOSHTIC = National Institute for Occupational Safety and Health Technical Information Center; NRC = National Research Council; NSCEP = National Service Center for Environmental Publications; NTP = National Toxicology Program; OECD = Organisation for Economic Cooperation and Development; OEHHA = Office of Environmental Health Hazard Assessment; OPP = Office of Pesticide Programs; OSHA = Occupational Safety and Health Administration; PEC = Priority Existing Chemical; REL = Reference Exposure Level; RoC = Report on Carcinogens; RTECS = Registry of Toxic Effects of Chemical Substances; SIDS = Screening Information Data Set; SRS = Substance Registry Services; UK = United Kingdom; UNEP = United Nations Environment Programme; WEEL = Workplace Environmental Exposure Level

B-2 Cyclic Aliphatic Bromine Cluster (HBCD) Synonyms

These are the synonyms of HBCD that were considered during the development of the database searches for fate, engineering, exposure and human health hazard information.

- HBCD
- hexabromocyclododecane
- 1,2,5,6,9,10-hexabromocyclododecane
- 1,2,5,6-tetrabromocyclooctane
- 25637-99-4
- 3194-55-6
- 3194-57-8
- cyclic aliphatic bromides
- Bromkal
- FR 104 (fireproofing agent)
- FR 1206
- FR 1206HT
- FR 1206ILM
- FR-CD
- HBCD-LM
- HBCD-LMS
- HBCD-SP 75
- HP 900
- HP 900G

- Great Lakes CD
- Nikkafainon
- Pyroguard
- Pyrovatex
- Saytex
- Bromkal 73-6CD
- Bromkal 73-6D
- Great Lakes CD-75
- Great Lakes CD-75P
- Great Lakes CD-75PC
- Great Lakes CD-75PM
- Great Lakes CD-75XF
- FR 1010
- FR 104
- Mylam 11645
- Nikka Fi-None CG 1
- Nikka Fi-None TS 1
- Nikka Fi-None CG 3
- Nikka Fi-None CG 88
- Pyroguard F 800
- 134237-50-6
- alpha-Hexabromocyclododecane
- 134237-51-7
- beta-Hexabromocyclododecane
- 134237-52-8
- gamma-Hexabromocyclododecane

B-3 Literature Search Strategies for Database Literature Searches for Fate, Engineering/Occupational Exposure, and Exposure

Table_Apx B-3. HBCD Fate, Engineering/Occupational Exposure, and Exposure Search Strategy for Web of Science

Search	Search Strategy
Chemical Terms*	(Great-Lakes-CD OR FR-104 OR FR-CD OR HP-900 OR hexabromocyclododecane OR HBCD OR 1,2,5,6-tetrabromocyclooctane OR 25637-99-4 OR Bromkal OR Pyrovatex OR Saytex)
Use Terms	AND (Architectural-mold* OR Auto* OR Beanbag* OR Board* OR Carpet* OR Car-seat* OR Coat* OR Composite OR Cutting OR EPS OR Flame-retard* OR Granulometry OR Headliner* OR Insulat* OR Laminate OR Mat OR Mold* OR Packag* OR particle-size OR polystyrene OR Roof* OR Textile* OR Thermal-insulation-board OR Upholster* OR XPS)
Exposure, Engineering, & Fate Terms	OR ((OECD AND Guideline*) OR (OPPTS AND guideline*) OR (OCSPP AND Guideline*) OR abiotic OR absorb OR absorption OR accumulation-rate OR activi* OR adipose OR adsorp* OR aerob* OR aerosol OR aerosols OR aged OR aggregate OR air OR amount-used OR anaerob* OR analy* OR anoxic OR area-source OR atm-m3/mol OR automotive OR BAF OR BCF OR bioaccumulat* OR bioavail* OR bioconcentrat* OR biodegrad* OR biomagnification OR biomoni* OR biosolids OR biota OR biotrans* OR breakdown-product OR breakdown-products OR breastmilk OR breast-milk OR breathing-zone OR brush-applied OR BSAF OR BSAFs OR building-envelope OR chamber OR chelation OR children OR coagulation OR coating OR commercial OR complexation OR conc* OR consumer OR contamination OR controls OR crawling OR creatinine OR cultural OR cumulative OR decay-rate OR degrad* OR degreaser OR dermal OR detect OR diffusion-coefficient OR disadvantaged OR disease OR dispers* OR disposal OR dissolution OR distribution OR diy OR do-it-yourself OR dose OR drinking-water OR dust OR education-level OR effluent OR elderly OR emission OR emissions OR engineering-controls OR English-as-a-second-language OR environmental-fate OR environmental-justice OR ethnicity OR evaporation-from-water OR excretion OR exposure OR facili* OR Female OR Females OR fence-line-population OR fetal OR fetus OR fish* OR flocculation OR flux OR formula OR fugacity OR garage OR gas-phase-mass-transfer OR gender OR general-population OR genetic-polymorphism OR genetic-traits OR geography OR geophag* OR geriatric OR German-human-biomonitoring-values OR groundwater OR ground-water OR guns OR half-life OR hand-to-mouth OR health-status OR henry's-law OR hobb* OR homeless OR hydroly* OR illegal-immigrants OR immunocompromised OR import* OR

Search	Search Strategy
	incinerate OR incineration OR income OR indigenous OR indoor-outdoor-ratio OR industrial OR infants OR influent OR ingestion OR inhal* OR intake OR inter-individual OR inter-zonal-air-flow OR intra-individual OR KAW OR Kd OR kinetics OR KOA OR KOC OR lacquer OR lactat* OR landfill OR landfills OR leach* OR lifecycle OR life-cycle OR lifestage OR life-stage OR lifestages OR life-stages OR lifestyle OR liquid-phase-mass-transfer OR loading OR Male OR males OR manuf* OR mass-transfer-coefficient OR menopaus* OR metaboli* OR microcosm OR migrat* OR modified-state-space OR monitoring OR mouthing OR near-facility-population OR nutrition-status OR occupa* OR occur OR occurrence OR OCSPP OR ocular OR older-adults OR on-site-treatment OR oral OR overspray-fraction OR partic* OR particle-size OR particulate OR partition* OR pathway OR pathways OR penetration-factor OR penetration-ratio OR perinatal OR persisten* OR personal OR photoly* OR photostability OR pica OR placenta OR plasma OR plume OR PM-10 OR PM-2.5 OR point-source OR point-sources OR pore-water OR postnatal OR POTW OR PPE OR preexisting-disease OR pregnan* OR prenatal OR preparedness OR pretreatment-program OR process* OR product OR protective OR proximity OR race OR recover* OR recreation* OR recycling OR redox OR release OR releases OR remed* OR residential OR residual OR rolled OR route OR routes OR rural OR sample OR samples OR school-age* OR sediment OR senior OR seniors OR sensitiv* OR serum OR SES OR sewage-treatment OR short-term OR shower* OR single-parent OR single-parents OR sink OR sinks OR site OR sites OR skin OR sludge OR socioeconomic-status OR soil OR solvent OR solvents OR sorb* OR sorp* OR source OR sources OR spray-applied OR stress* OR subpopulation OR subsistence OR subsurface-intrusion OR Superfund OR surface-water-concentration OR susceptib* OR time-weighted-average OR toddler OR toddlers OR transfer OR transformation OR tribal OR trophic-magnification OR urban OR urine OR use OR uses OR vapor OR ventilat* OR volatil* OR volume OR vulnerab* OR wait-time OR wastewater-treatment OR water OR weight-fraction OR wildlife OR wipe OR women-of-childbearing-age OR Worker OR workers OR workplace OR WWTP OR young)
Limits	• Refined by: RESEARCH AREAS: (AGRICULTURE OR MARINE FRESHWATER BIOLOGY OR PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH OR MATERIALS SCIENCE OR CONSTRUCTION BUILDING TECHNOLOGY OR METEOROLOGY ATMOSPHERIC SCIENCES OR ENGINEERING OR WATER RESOURCES OR ENVIRONMENTAL SCIENCES ECOLOGY OR ZOOLOGY) • Indexes=SCI-EXPANDED, SSCI
Date of Search: 2/28/2017	

Search	Search Strategy

*Synonyms not found in Web of Science were removed from consideration in the search.

B-4 Literature Search Strategies for Database Literature Searches for Human Health

Table_Apx B-4. Cyclic Aliphatic Bromine Cluster (HBCD) Human Health Hazard Peer-Reviewed Literature Search Strategy

Set	Search Strategy
Pub Med[1]	
Chemical Terms	(hexabromocyclododecane[tiab] OR hexabromocyclododecane[Supplementary Concept] OR HBCD[tiab] OR 1,2,5,6-tetrabromocyclooctane[tiab] OR 25637-99-4[rn] OR Bromkal[tiab] OR Pyrovatex[tiab] OR Saytex[tiab])
Health Effect Terms	AND ((DNA[tiab] AND breaks[tiab]) OR absorption[tiab] OR absorption[mh] OR activate[tiab] OR activated[tiab] OR acute[tiab] OR adverse[tiab] OR adverse-effects[sh] OR Ames-assay[tiab] OR Ames-test[tiab] OR animal[tiab] OR blood[tiab] OR blood[mh] OR brain[mh] OR brain[tiab] OR cancer[tiab] OR carcinogen[tiab] OR carcinogenesis[tiab] OR carcinogenic[tiab] OR carcinogenicity[tiab] OR carcinogens[tiab] OR carcinogens[mh] OR cardiac[tiab] OR case-control[tiab] OR case-control-studies[mh] OR case-referent[tiab] OR case-report[tiab] OR case-reports[tiab] OR case-reports[pt] OR cell[tiab] OR cell-proliferation[mh] OR cells[tiab] OR cells[mh] OR chemokine[tiab] OR chemokines[tiab] OR chromosomal-aberration[tiab] OR chromosomal-aberration[tiab] OR chromosomal-aberrations[tiab] OR chromosomal-aberrations[mh] OR chronic[tiab] OR cognitive[tiab] OR cohort[tiab] OR cohort-studies[mh] OR congenital-abnormalities[mh] OR corrosion[mh] OR corrosion[tiab] OR crosslink[tiab] OR cytogenicity[tiab] OR cytokine[tiab] OR cytokines[tiab] OR cytokines[mh] OR cytotoxic[tiab] OR cytotoxicity[tiab] OR dam[tiab] OR dams[tiab] OR death[mh] OR death[tiab] OR dermal[tiab] OR detoxification[tiab] OR detoxify[tiab] OR development[tiab] OR developmental[tiab] OR diet[mh] OR diet[tiab] OR dietary[tiab] OR diets[tiab] OR distribution[tiab] OR DNA-adduct[tiab] OR DNA-adducts[mh] OR DNA-adducts[tiab] OR DNA-breaks[mh] OR DNA-damage[mh] OR DNA-damage[tiab] OR DNA-repair[mh] OR DNA-repair[tiab] OR dog[tiab] OR dogs[tiab] OR dogs[mh] OR dose[tiab] OR drinking-water[tiab] OR drinking-water[mh] OR eliminate[tiab] OR elimination[tiab] OR embryo[tiab] OR embryonic[tiab] OR embryos[tiab] OR employee[tiab] OR employees[tiab] OR endocrine[tiab] OR endpoint[tiab] OR endpoints[tiab] OR enteral-nutrition[mh] OR epidemiologic[tiab] OR epidemiological[tiab] OR epidemiology[mh] OR epidemiology[sh] OR epidemiology[tiab] OR epigenetic[tiab] OR epigenetics[tiab] OR epigenomics[tiab] OR epigenomics[mh] OR female[tiab] OR females[tiab] OR fetal[tiab] OR fetus[tiab] OR fetus[mh] OR fetuses[tiab] OR gavage[tiab] OR Gene[tiab] OR gene-

Set	Search Strategy
	expression[mh] OR genes[tiab] OR genes[mh] OR genetic[tiab] OR genetics[tiab] OR genotoxic[tiab] OR genotoxicity[tiab] OR germ-line-mutation[tiab] OR germ-line-mutation[mh] OR growth-and-development[mh] OR guinea-pig[tiab] OR guinea-pigs[tiab] OR guinea-pigs[mh] OR hamster[tiab] OR hamsters[tiab] OR hazard[tiab] OR heart[tiab] OR heart[mh] OR hemotoxic[tiab] OR hemotoxicity[tiab] OR hemotoxin[tiab] OR hemotoxins[tiab] OR hepatic[tiab] OR hepatotoxic[tiab] OR hepatotoxicity[tiab] OR hepatotoxin[tiab] OR hepatotoxins[tiab] OR human[tiab] OR humans[tiab] OR humans[mh] OR immunotoxic[tiab] OR immunotoxicity[tiab] OR immunotoxin[tiab] OR immunotoxins[tiab] OR immunotoxins[mh] OR incidence[tiab] OR incidences[tiab] OR individual[tiab] OR individuals[tiab] OR inflammation[tiab] OR inflammation[mh] OR inflammatory[tiab] OR inhalation[tiab] OR inhalation[mh] OR inhale[tiab] OR inhaled[tiab] OR inhibit[tiab] OR inhibited[tiab] OR inhibitory[tiab] OR interact[tiab] OR interacted[tiab] OR interaction[tiab] OR intestine[tiab] OR intestines[tiab] OR intestines[mh] OR in-vitro[tiab] OR in-vitro-techniques[mh] OR in-vivo[tiab] OR irritation[tiab] OR kidney[tiab] OR kidney[mh] OR LC50[tiab] OR LD50[tiab] OR lethal-concentration-50[tiab] OR Lethal-Dose-50[tiab] OR Lethal-Dose-50[mh] OR litter[tiab] OR litters[tiab] OR liver[tiab] OR liver[mh] OR LOAEC[tiab] OR LOAEL[tiab] OR LOEL[tiab] OR longitudinal[tiab] OR long-term-adverse-effects[mh] OR lung[tiab] OR lung[mh] OR male[tiab] OR malformation[tiab] OR malformations[tiab] OR malformed[tiab] OR malignancies[tiab] OR malignancy[tiab] OR malignant[tiab] OR margin-of-exposure[tiab] OR maternal[tiab] OR mechanism[tiab] OR mechanisms[tiab] OR mechanistic[tiab] OR metabolism[tiab] OR metabolism[mh] OR metabolism[sh] OR metastasis[tiab] OR metastasize[tiab] OR metastatic[tiab] OR mg/kg/day[tiab] OR mg/kg-bw/day[tiab] OR mg/L[tiab] OR mg/m3[tiab] OR mg-kg/day[tiab] OR mice[mh] OR mice[tiab] OR micronuclei[tiab] OR micronucleus[tiab] OR mode-of-action[tiab] OR monkey[tiab] OR monkeys[tiab] OR mortality[mh] OR mortality[tiab] OR mouse[tiab] OR mouth[tiab] OR mouth[mh] OR mutagen[tiab] OR mutagenesis[tiab] OR mutagenic[tiab] OR mutagens[mh] OR mutagens[tiab] OR mutation[tiab] OR mutation[mh] OR nasal[tiab] OR neoplasm[tiab] OR neoplasms[tiab] OR neoplasms[mh] OR neoplastic[tiab] OR nephrotoxic[tiab] OR nephrotoxicity[tiab] OR nephrotoxin[tiab] OR nephrotoxins[tiab] OR nested[tiab] OR neurobehavior[tiab] OR neurobehavioral[tiab] OR neurologic[tiab] OR neurological[tiab] OR neurophysiological[tiab] OR neuropsychological[tiab] OR neurotoxic[tiab] OR neurotoxicity[tiab] OR neurotoxin[tiab] OR neurotoxins[tiab] OR neurotoxins[mh] OR NOAEC[tiab] OR NOAEL[tiab] OR NOEL[tiab] OR nonmalignant[tiab] OR nonneoplastic[tiab] OR nose[tiab] OR nose[mh] OR OECD-Test-Guideline[tiab] OR OECD-Test-Guidelines[tiab] OR oncogene[tiab] OR oncogenes[tiab] OR oncogenes[mh]

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	OR oncogenesis[tiab] OR oral[tiab] OR organ[tiab] OR organs[tiab] OR ototoxic[tiab] OR ototoxicity[tiab] OR oxidative-damage[tiab] OR oxidative-stress[tiab] OR oxidative-stress[mh] OR participant[tiab] OR participants[tiab] OR paternal[tiab] OR PBPK[tiab] OR people[tiab] OR perinatal[tiab] OR person[tiab] OR pharmacodynamic[tiab] OR pharmacodynamics[tiab] OR pharmacokinetic[tiab] OR pharmacokinetics[mh] OR pharmacokinetics[tiab] OR pharmacokinetics[sh] OR pharmacology[sh] OR pharmacology[mh] OR pharmacology[tiab] OR polyploid[tiab] OR polyploidy[tiab] OR polyploidy[mh] OR postnatal[tiab] OR pregnancy[mh] OR pregnancy[tiab] OR pregnancy-complications[mh] OR pregnant[tiab] OR prenatal[tiab] OR prevalence[tiab] OR prevalent[tiab] OR promote[tiab] OR promotion[tiab] OR pulmonary[tiab] OR rabbit[tiab] OR rabbits[tiab] OR rabbits[mh] OR rat[tiab] OR rats[mh] OR rats[tiab] OR registries[mh] OR registries[tiab] OR registry[tiab] OR renal[tiab] OR reproduction[tiab] OR reproduction[mh] OR reproductive[tiab] OR reprotoxic[tiab] OR reprotoxicity[tiab] OR respiration[mh] OR respiration[tiab] OR respiratory[tiab] OR rodent[tiab] OR rodents[tiab] OR SCE[tiab] OR sensitization[tiab] OR sensitized[tiab] OR sensitizer[tiab] OR sensitizing[tiab] OR sister-chromatid-exchange[mh] OR sister-chromatid-exchange[tiab] OR skeletal[tiab] OR skin[tiab] OR skin[mh] OR subchronic[tiab] OR sub-chronic[tiab] OR subject[tiab] OR subjects[tiab] OR systemic[tiab] OR teratogen[tiab] OR teratogenic[tiab] OR teratogens[tiab] OR teratogens[mh] OR toxic[tiab] OR toxicant[tiab] OR toxicants[tiab] OR toxicity[sh] OR Toxicity[tiab] OR Toxicity[sh] OR toxicodynamic[tiab] OR toxicodynamics[tiab] OR toxicokinetic[tiab] OR toxicokinetics[tiab] OR toxicokinetics[mh] OR toxicology[mh] OR toxicology[tiab] OR tumor[tiab] OR tumorigenic[tiab] OR tumors[tiab] OR weight[tiab] OR worker[tiab] OR workers[tiab] OR Adolescen*[tiab] OR Adult*[tiab] OR Age[tiab] OR aged[tiab] OR age-groups[mh] OR ages[tiab] OR Alcohol[tiab] OR At-risk[tiab] OR BMI[tiab] OR body-mass-index[tiab] OR body-mass-index[mh] OR boy[tiab] OR boys[tiab] OR child[tiab] OR children[tiab] OR cigar[tiab] OR Cigarette[tiab] OR cigarettes[tiab] OR cigars[tiab] OR Coexposure[tiab] OR co-exposure[tiab] OR Critical-window*[tiab] OR Diabetes[tiab] OR diabetes-insipidus[mh] OR diabetes-mellitus[mh] OR disadvantaged[tiab] OR Early-life[tiab] OR Elderly[tiab] OR Environmental-justice[tiab] OR Ethanol[tiab] OR Ethnic[tiab] OR ethnic-groups[mh] OR ethnicit*[tiab] OR Females[tiab] OR gastrointestinal-microbiome[mh] OR Gender[tiab] OR Genotype[tiab] OR genotype[mh] OR Genotypes[tiab] OR genotypic[tiab] OR Geriatric[tiab] OR gestation[tiab] OR gestational[tiab] OR girl[tiab] OR girls[tiab] OR Gut[tiab] OR Haplotype[tiab] OR Haplotypes[tiab] OR haplotypes[mh] OR Health-status[mh] OR Health-status[tiab] OR Inequalit*[tiab] OR Inequit*[tiab] OR infancy[tiab] OR infant[tiab] OR infants[tiab] OR In-

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	utero[tiab] OR lifestage[tiab] OR Life-stage[tiab] OR lifestages[tiab] OR Life-stages[tiab] OR Males[tiab] OR Men[mh] OR Men[tiab] OR Metagenomic[tiab] OR metagenomics[tiab] OR metagenomics[mh] OR methylation[mh] OR Methylation[tiab] OR Microbiome[tiab] OR Microbiomes[tiab] OR Microbiota[tiab] OR minorities[tiab] OR minorities[tiab] OR Minority[tiab] OR minority-groups[mh] OR Modifying-factor[tiab] OR Modifying-factors[tiab] OR natal[tiab] OR newborn[tiab] OR newborns[tiab] OR Nicotine[tiab] OR nicotine[mh] OR nutritional-status[mh] OR nutritional-status[tiab] OR placenta[mh] OR placenta[tiab] OR placental[tiab] OR Polymorphism[tiab] OR polymorphism,-genetic[mh] OR polymorphisms[tiab] OR poverty[mh] OR Poverty[tiab] OR Preexisting[tiab] OR pre-existing[tiab] OR pregnant-women[mh] OR Preschool[tiab] OR preschooler[tiab] OR preschoolers[tiab] OR Race[tiab] OR Racial[tiab] OR racism[mh] OR racism[tiab] OR Sensitive-population[tiab] OR Sensitive-populations[tiab] OR SES[tiab] OR sex[mh] OR Sex[tiab] OR smoke[tiab] OR Smoke[mh] OR smoker[tiab] OR smokers[tiab] OR smoking[tiab] OR smoking[mh] OR Sociocultural[tiab] OR sociodemographic[tiab] OR Socioeconomic[tiab] OR socio-economic[tiab] OR socioeconomic-factors[mh] OR Susceptibilities[tiab] OR Susceptibility[tiab] OR Susceptible[tiab] OR teenager[tiab] OR teenagers[tiab] OR teens[tiab] OR Tobacco[tiab] OR tobacco-products[mh] OR toddler[tiab] OR toddlers[tiab] OR underserved[tiab] OR Vulnerabilities[tiab] OR Vulnerability[tiab] OR Vulnerable[tiab] OR vulnerable-populations[mh] OR Women[mh] OR Women[tiab] OR cardiovascular[tiab])
Limits	2016 to present
Date of Search: 2/14/2017	
Web of Science[2]	
Chemical Terms	(Great-Lakes-CD OR FR-104 OR FR-CD OR HP-900 OR hexabromocyclododecane OR HBCD OR 1,2,5,6-tetrabromocyclooctane OR 25637-99-4 OR Bromkal OR Pyrovatex OR Saytex)
Health Effect Terms	AND ((DNA AND breaks) OR absorption OR activate OR activated OR acute OR adverse OR Ames-assay OR Ames-test OR animal OR blood OR brain OR cancer OR carcinogen OR carcinogenesis OR carcinogenic OR carcinogenicity OR carcinogens OR cardiac OR case-control OR case-referent OR case-report OR case-reports OR cell OR cells OR chemokine OR chemokines OR chromosomal-aberration OR chromosomal-aberration OR chromosomal-aberrations OR chronic OR cognitive OR cohort OR corrosion OR crosslink OR cytogenicity OR cytokine OR cytokines OR cytotoxic OR cytotoxicity OR dam OR dams OR death OR dermal OR detoxification OR detoxify OR development OR developmental OR diet OR dietary OR diets OR distribution OR DNA-adduct OR DNA-adducts OR DNA-

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	damage OR DNA-repair OR dog OR dogs OR dose OR drinking-water OR eliminate OR elimination OR embryo OR embryonic OR embryos OR employee OR employees OR endocrine OR endpoint OR endpoints OR epidemiologic OR epidemiological OR epidemiology OR epigenetic OR epigenetics OR epigenomics OR female OR females OR fetal OR fetus OR fetuses OR gavage OR Gene OR genes OR genetic OR genetics OR genotoxic OR genotoxicity OR germ-line-mutation OR guinea-pig OR guinea-pigs OR hamster OR hamsters OR hazard OR heart OR hemotoxic OR hemotoxicity OR hemotoxin OR hemotoxins OR hepatic OR hepatotoxic OR hepatotoxicity OR hepatotoxin OR hepatotoxins OR human OR humans OR immunotoxic OR immunotoxicity OR immunotoxin OR immunotoxins OR incidence OR incidences OR individual OR individuals OR inflammation OR inflammatory OR inhalation OR inhale OR inhaled OR inhibit OR inhibited OR inhibitory OR interact OR interacted OR interaction OR intestine OR intestines OR in-vitro OR in-vivo OR irritation OR kidney OR LC50 OR LD50 OR lethal-concentration-50 OR Lethal-Dose-50 OR litter OR litters OR liver OR LOAEC OR LOAEL OR LOEL OR longitudinal OR lung OR male OR malformation OR malformations OR malformed OR malignancies OR malignancy OR malignant OR margin-of-exposure OR maternal OR mechanism OR mechanisms OR mechanistic OR metabolism OR metastasis OR metastasize OR metastatic OR mg/kg/day OR mg/kg-bw/day OR mg/L OR mg/m3 OR mg-kg/day OR mice OR micronuclei OR micronucleus OR mode-of-action OR monkey OR monkeys OR mortality OR mouse OR mouth OR mutagen OR mutagenesis OR mutagenic OR mutagens OR mutation OR nasal OR neoplasm OR neoplasms OR neoplastic OR nephrotoxic OR nephrotoxicity OR nephrotoxin OR nephrotoxins OR nested OR neurobehavior OR neurobehavioral OR neurologic OR neurological OR neurophysiological OR neuropsychological OR neurotoxic OR neurotoxicity OR neurotoxin OR neurotoxins OR NOAEC OR NOAEL OR NOEL OR nonmalignant OR nonneoplastic OR nose OR OECD-Test-Guideline OR OECD-Test-Guidelines OR oncogene OR oncogenes OR oncogenesis OR oral OR organ OR organs OR ototoxic OR ototoxicity OR oxidative-damage OR oxidative-stress OR participant OR participants OR paternal OR PBPK OR people OR perinatal OR person OR pharmacodynamic OR pharmacodynamics OR pharmacokinetic OR pharmacokinetics OR pharmacology OR polyploid OR polyploidy OR postnatal OR pregnancy OR pregnant OR prenatal OR prevalence OR prevalent OR promote OR promotion OR pulmonary OR rabbit OR rabbits OR rat OR rats OR registries OR registry OR renal OR reproduction OR reproductive OR reprotoxic OR reprotoxicity OR respiration OR respiratory OR rodent OR rodents OR SCE OR sensitization OR sensitized OR sensitizer OR sensitizing OR sister-chromatid-exchange OR skeletal OR skin OR subchronic OR sub-chronic OR subject OR subjects OR systemic OR teratogen OR

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	teratogenic OR teratogens OR toxic OR toxicant OR toxicants OR Toxicity OR toxicodynamic OR toxicodynamics OR toxicokinetic OR toxicokinetics OR toxicology OR tumor OR tumorigenic OR tumors OR weight OR worker OR workers OR Adolescen* OR Adult* OR Age OR aged OR ages OR Alcohol OR At-risk OR BMI OR body-mass-index OR boy OR boys OR child OR children OR cigar OR Cigarette OR cigarettes OR cigars OR Coexposure OR co-exposure OR Critical-window* OR Diabetes OR disadvantaged OR Early-life OR Elderly OR Environmental-justice OR Ethanol OR Ethnic OR ethnicit* OR Females OR Gender OR Genotype OR Genotypes OR genotypic OR Geriatric OR gestation OR gestational OR girl OR girls OR Gut OR Haplotype OR Haplotypes OR Health-status OR Inequalit* OR Inequit* OR infancy OR infant OR infants OR In-utero OR lifestage OR Life-stage OR lifestages OR Life-stages OR Males OR Men OR Metagenomic OR metagenomics OR Methylation OR Microbiome OR Microbiomes OR Microbiota OR minorities OR minorities OR Minority OR Modifying-factor OR Modifying-factors OR natal OR newborn OR newborns OR Nicotine OR nutritional-status OR placenta OR placental OR Polymorphism OR polymorphisms OR Poverty OR Preexisting OR pre-existing OR Preschool OR preschooler OR preschoolers OR Race OR Racial OR racism OR Sensitive-population OR Sensitive-populations OR SES OR Sex OR smoke OR smoker OR smokers OR smoking OR Sociocultural OR sociodemographic OR Socioeconomic OR socio-economic OR Susceptibilities OR Susceptibility OR Susceptible OR teenager OR teenagers OR teens OR Tobacco OR toddler OR toddlers OR underserved OR Vulnerabilities OR Vulnerability OR Vulnerable OR Women OR cardiovascular)
Limits	• 2016 to present • Refined by: RESEARCH AREAS: (BIOCHEMISTRY MOLECULAR BIOLOGY OR PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH OR CELL BIOLOGY OR REPRODUCTIVE BIOLOGY OR IMMUNOLOGY OR INFECTIOUS DISEASES OR DEVELOPMENTAL BIOLOGY OR TOXICOLOGY OR ONCOLOGY) • Indexes=SCI-EXPANDED, SSCI
Date of Search: 2/14/2017	
Toxline[3]	
Chemical Terms	(25637-99-4)
Health Effect Terms	Identical to Web of Science Health Effect Terms
Limits	2016 to present Include CASRNs and synonyms Exclude PubMed records

Set	Search Strategy
Date of Search: 2/14/2017	

[1] Synonyms not found in PubMed were removed from consideration in the search; [mh] searched in MeSH field; [tiab] searched in title or abstract fields; [sh] searched in subheading field.

[2] Synonyms not found in Web of Science were removed from consideration in the search.

[3] Synonyms searched automatically

C. GRAY LITERATURE SEARCHES FOR FATE, ENGINEERING/OCCUPATIONAL EXPOSURE, EXPOSURE, AND HUMAN HEALTH HAZARD

The gray literature search for fate, engineering, exposure, and human health hazard was done with a goal of efficiency. For this reason, websites were automatically searched wherever possible. After creating the list of sites to search, three categories of websites were identified that required a different search strategy as explained below.

- *Websites that can be effectively searched using Google*: these websites and corresponding subsites have relevant documents that can be searched using Google. EPA/OPPT used Google's API that allows the user to create custom searches restricted by both keyword list and URL list. This approach greatly increased the speed of the searches, since code was written to implement the searches automatically. The following key restrictions, however, were encountered during the search:
  - The API returns the first 100 sites found, after sorting for predicted relevancy. As with all Google searches, Google attempts to rank the returned URLs in terms of overall relevancy to the search terms. However, if 3,600 sites are returned by the search, only the first 100 according to Google's ranked order are returned.
    The search strings in Google and the Google API are restricted to 128 characters. For HBCD, the following search string was created to have the maximum number of chemical synonyms/CAS numbers without exceeding 128 characters: "3194-55-6" OR "3194-57-8" OR "134237-50-6" OR "134237-51-7" OR "134237-52-8" OR "hexabromocyclododecane" OR "HBCD"

- *Websites that can be searched using custom code but not using Google:* these websites have relevant data and/or information in the form of PDFs and the searches can be automated by developing custom code that locates and downloads (i.e., "scrapes") all of the targeted PDFs.
  - ATSDR and NIOSH documents: ATSDR has a series of Public Health Assessments and Health Consultations, and NIOSH has a series of Human Hazard Evaluations that may have documents relevant for the TSCA risk evaluation. Each document is housed at specific URLs within the ATSDR and NIOSH websites. Python code was used to automatically download 100 documents from each site.
  - EPA National Electronic Publications Information System (NEPIS) website: The EPA NEPIS website was another one that used custom code to search. NEPIS houses EPA reports and documents that can be searched by keyword. The NEPIS site uses its own search engine that is not retrievable using Google. Thus, python code was developed to directly access the website search engine and automatically pull the top 100 returned PDFs.
- *Websites that are searched manually:* a manual search is required because the websites house a database or they use their own search engine to retrieve information (e.g., ChemView, NHANES).

The overall strategy for searching these sites is shown in Table_Apx C-1. The lists of sites that were searched (with site-specific inclusion/exclusion criteria) are provided in Table_Apx C-2 and Table_Apx C-3. The sites that were originally on the list but removed during curation are provided in Table_Apx C-4.

Table_Apx C-1. Overview of Search Strategy for Gray Literature for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard Topic Areas

Search Type	How was List Created?	Sub Search Type	How Was Source Searched?	Search Terms	Date Limit	Literature Search Notes
US Government and International Websites	Compiling list of sources, sources cited in existing problem formulation and assessment documents, and sources cited in the public use document	Manual (sites that cannot be searched using Google)	Searched manually	3194-55-6, 3194-57-8, 134237-50-6, 134237-51-7, 134237-52-8 or hexabromocyclododecane	None	• Searched all sites and subsites using the HBCD CAS numbers (3194-55-6, 3194-57-8, 134237-50-6, 134237-51-7, 134237-52-8) or the substance name (hexabromocyclododecane) • Pulled the most recent draft (either draft or final) for assessments.
		Automated, Google API	Searched using Google API	"3194-55-6" OR "3194-57-8" OR “134237-50-6” OR “134237-51-7” OR “134237-52-8” OR hexabromocyclo-dodecane" OR "HBCD"	None	• Search string is 115 characters (below the 128 character limit) • Google’s API returns the top 100 hits from each site
		Automated, EPA NEPIS	Searched using code that pulls 100 subsites/pdfs	Two separate searches, using "HBCD" and then "hexabromo-cyclododecane"	1991	• The NEPIS database is a warehouse for EPA documents and reports, and it is not accessible by Google. ICF wrote a custom search for that website. • The site is searchable by keyword only, so two searches were done using the short name (HBCD) and the full chemical name (hexabromocyclododecane) • The database was searched using a date limit of 1991 to prioritize the 100 most recent EPA documents.
		Automated, ATSDR and NIOSH	Searched using code that pulls 100 subsites/pdfs	“Hexabromocyclododecane”	None	• Both sources contain a large number of assessments on specific subsites • Up to 100 documents were downloaded for each chemical
Trade Association Websites	Using National Association of Manufacturers members list and public use document	Google API	Searched using Google API	"3194-55-6" OR "3194-57-8" OR “134237-50-6” OR “134237-51-7” OR “134237-52-8” OR "hexabromocyclo-dodecane" OR "HBCD"	None	• Search string is 115 characters (below the 128 character limit) • Google’s API returns the top 100 hits from each site
State Websites	Searching for environ. quality/ management, environ. health/human health, and occupational	Google API	Searched using Google API	("3194-55-6" OR "hexabromocyclododecane" OR "HBCD") AND (assessment OR data)	None	• State sites tended to have a lot of regulatory or outreach documents which are expected to be less on-topic • To focus on reports, assessments, and data, the search string was modified to include the words “data” and “assessment”

	health and safety subsites					

Table_Apx C-2. Sources Used For Gray Literature Search for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard Topic Areas with Source-Specific Inclusion/Exclusion Criteria

ID	Trusted Source Category	Source	Source Address	Manual or Automated	Search by?	Search Terms[1]	Source-Specific Inclusion Criteria	Source-Specific Exclusion Criteria
1001	US EPA Resources	Office of Water: EPA Water Regulations*	https://www.epa.gov/regulatory-information-topic/regulatory-information-topic-water	Manual	Chemical	CAS or chemical name	Drinking water regulations under development or currently in place	None
1006	US EPA Resources	Drinking Water Standards and Health Advisories	https://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf	Manual	Chemical	CAS or chemical name	All chemicals covered by the 2012 standards	None
1008	US EPA Resources	Office of Water: STORET and WQX	https://www.epa.gov/waterdata/storage-and-retrieval-and-water-quality-exchange	Manual	Chemical	CAS or chemical name	The database was downloaded and text files with data specific to included chemicals (metadata and results) were saved in zip files. The website states that the data warehouse includes all data supplied to EPA since 1999.	None
1010	US EPA Resources	Office of Air Quality Planning and Standards (OAQPS)	epa.gov/airquality/	Automated	Chemical	Google API terms	Documents containing information about control technologies used to control emissions	FR notices not directly pertaining to chemical of interest; broken links
1011	US EPA Resources	Office of Air: Air Emission Factors*	https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors	Manual	Industrial Sector	Sectors and uses identified from public use document and Chemical Data Reporting data	Reviewed chapters to identify information relevant to industrial sectors using professional experience/judgment	None
1012	US EPA Resources	Office of Air: Emission Inventory	https://www.epa.gov/air-	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	

		Improvement Program	emissions-inventories/emission-inventory-improvement-program-eiip					
1013	US EPA Resources	Office of Air: National Emissions Inventory (NEI)	https://www.epa.gov/air-emissions-inventories/national-emissions-inventory	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
1014	US EPA Resources	Office of Air: Ambient Water Quality Criteria documents	epa.gov/wqc	Automated	Chemical	Google API terms	Most-recent water quality criteria human health tables and supporting documents	Previous (prior to 2015) water quality criteria documents; documents not directly pertaining to the chemical of interest
1015	US EPA Resources	Office of Air: HAPS	epa.gov/haps/initial-list-hazardous-air-pollutants-modifications	Automated	Chemical	Google API terms	None	Lists of chemical classified as hazardous air pollutants covered in other sources (covered in the "Lists of Lists" source)
1016	US EPA Resources	Office of Air: NESHAP*	epa.gov/technical-air-pollution-resources	Automated	Chemical	Google API terms	No results returned by search	No results returned by search
1031	US EPA Resources	Office of Air: Urban Air Toxics	https://www.epa.gov/urban-air-toxics/urban-air-toxic-pollutants	Manual	Chemical	CAS or chemical name	List of chemicals classified as urban air toxics	None
1032	US EPA Resources	OPPT: TRI, including TRI Guidance Documents*	epa.gov/tri	Automated	Chemical	Google API terms	Statistics on emission reductions. Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	Fact sheets, reporting forms, grant program information, data (data is provided in a different source)
1038	US EPA Resources	OPPT: TSCA Analog Identification Methodology (AIM)	http://www.epa.gov/tsca-screening-tools/analog-identification-methodology-aim-tool	Manual	Chemical	CAS or chemical name	The AIM tool was downloaded and searched to find records for HBCD	None

1059	US EPA Resources	Significant New Alternatives Policy (SNAP)	epa.gov/snap	Automated	Chemical	Google API terms	None	Lists of substitutes in different use sectors that link to specific FR notices from the 1990's
1061	US EPA Resources	Safer Choice	epa.gov/saferchoice/	Automated	Chemical	Google API terms	None	Very high-level fact sheets or assessment overviews; assessments found in other sources; staff directories
1064	US EPA Resources	Pollution Prevention	epa.gov/p2/	Automated	Chemical	Google API terms	None	Very high-level fact sheets and case studies; contact information
1070	US EPA Resources	Pesticide Chemical Search	https://iaspub.epa.gov/apex/pesticides/f?p=chemicalsearch:1	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs	Additional links on the search return page (included in other sources)
1073	US EPA Resources	InertFinder	https://iaspub.epa.gov/apex/pesticides/f?p=101:1:	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs	None
1075	US EPA Resources	Pesticide Ingredients	epa.gov/ingredients-used-pesticide-products	Automated	Chemical	Google API terms	None	High level summaries supporting decisions about classifying inert ingredients
1078	US EPA Resources	Hazardous Waste	epa.gov/hw/	Automated	Chemical	Google API terms	Reports to Congress or other material supporting regulatory decisions	Regulatory documents
1080	US EPA Resources	Superfund chemical data matrix	https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm-query	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs	None
1081	US EPA Resources	Superfund Enterprise Management System (SEMS)	cumulis.epa.gov/supercpad/cursites	Automated	Chemical	Google API terms	Quantitative risk assessments performed for Superfund sites	General Superfund site information that did not include quantitative measures of contaminant or exposure
1083	US EPA Resources	CPCat	https://actor.epa.gov/cpcat/faces/search.xhtml	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs	None
1090	US EPA Resources	NCEA IRIS	epa.gov/iris	Automated	Chemical	Google API terms	Supporting information for IRIS assessments	Main IRIS landing pages and information from the IRIS Tracker
1097	US EPA Resources	NCEA IRIS	https://cfpub.epa.gov/ncea/iris/search/	Manual	Chemical	CAS or chemical name	IRIS overview pages, summary pages, and full toxicological profiles	None
1101	US EPA Resources	ChemView (CDR/IUR)*, with links to hazard	http://java.epa.gov/chemview	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs,	None

		characterizations, substantial risk reports, chemical reporting data, chemical test rule data, High Production Volume Information System (HPVIS) data, and alternatives assessments.					other than IRIS assessments that were returned from other sources	
1103	US EPA Resources	Stationary Sources Air Pollution	epa.gov/stationary-sources-air-pollution/	Automated	Chemical	Google API terms	Documents supporting NESHAP that may contain quantitative data	NESHAP rules and FR notices (regulatory only)
1110	US EPA Resources	Economic and cost assessment	epa.gov/economic-and-cost-analysis-air-pollution-regulations	Automated	Chemical	Google API terms	Documents containing quantitative data	Documents not containing quantitative data
1113	US EPA Resources	NSCEP documents (NEPIS)	https://nepis.epa.gov/Exe/ZyNET.exe?ZyActionL=Register&User=anonymous&Password=anonymous&Client=EPA&Init=1	Automated	Chemical	NEPIS	Documents providing quantitative assessments or data	Fact sheets; documents supporting rules that do not have quantitative data
1118	US EPA Resources	Regulatory Development and Retrospective Review Tracker	yosemite.epa.gov/opei/rulegate.nsf/	Automated	Chemical	Google API terms	None	Lists of regulations expected to affect particular interests
1120	US EPA Resources	"List of Lists"	https://www.epa.gov/sites/production/files/2015-03/documents/list_of_lists.pdf	Manual	Chemical	CAS or chemical name	List of chemicals covered by specific EPA programs	None
1123	US EPA Resources	TSCATS 2.0	https://yosemite.epa.gov/opts/epatscat8.nsf/reportsearch?openform	Manual	Chemical	CAS or chemical name	The database was searched and all low detail report results were PDFed	None
1125	US EPA Resources	EPA Manufacturing/Use	Search epa.gov for each	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	

			manufacturing sector and use and key words for each manufacturing sector					
1141	US EPA Resources	OECA Sector Notebooks	The Sector Notebooks have been archived. Conduct an internet search with the keyword "OECA sector notebook" to see whether there has been a Sector Notebook prepared for the relevant industry	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
1143	US EPA Resources	EPA Generic Scenarios*	Review the list of currently approved Generic Scenarios for relevant information. The scenarios provide information on process descriptions and guidelines for release and exposure estimates for specific industry sectors.	Manual	Industrial Sector	Sectors and uses identified from public use document and Chemical Data Reporting data	Reviewed the list of currently approved Generic Scenarios for relevant information using professional judgment/experience. The scenarios provide information on process descriptions and guidelines for release and exposure estimates for specific industry sectors.	Information that does not inform the lifecycle diagram or conceptual model.
1144	US EPA Resources	HPV challenge submissions*	cfpub.epa.gov/hpv-s/	Automated	Chemical	Google API terms	Documents providing information relevant to the lifecycle diagrams and conceptual model	Broken links

							using professional judgment/experience. Additional quantitative assessments or data were also pulled as part of the broad search.	
1145	US EPA Resources	OPPT Hazard Characterizations	https://ofmpub.epa.gov/opptthpv/hpv_hc_characterization.get_report_by_cas?doctype=2 [the list of chemicals that have hazard characterizations] with supplemental search for the hazard characterization documents, which are published at https://java.epa.gov/chemview (source id 1101) https://ofmpub.epa.gov/opptthpv/hpv_hc_characterization.get_report_by_cas?doctype=2	Manual	Chemical	CAS or chemical name	No results returned by search	No results returned by search
1146	US EPA Resources	EHPV Program Submissions	https://www.regulations.gov/docket?D=EPA-HQ-OPPT-2006-1020	Manual	Chemical	CAS or chemical name	No results returned by search	No results returned by search
1147	US EPA Resources	CDAT	https://java.epa.gov/oppt_chemical_search/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in PDFs	None
1148	US EPA Resources	OPPT Risk-Based Prioritizations	https://iaspub.epa.gov/oppthpv/existchem_hpv_prioritizations.report	Manual	Chemical	CAS or chemical name	No results returned by search	No results returned by search

			[the list of chemicals that have prioritizations] with supplemental search for the prioritization reports, which are published at https://java.epa.gov/chemview (source id 1101)https://iaspub.epa.gov/oppthpv/existchem_hpv_prioritizations.reporthttps://iaspub.epa.gov/oppthpv/existchem_hpv_prioritizations.report					
1149	US EPA Resources	Office of Air: NATA	https://www.epa.gov/national-air-toxics-assessment/2011-nata-assessment-results#pollutant	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in zip files	None
1150	US EPA Resources	Office of Air: AQS	http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html#Annual	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in csv files	None
1151	US EPA Resources	OPPT Monitoring Database	Monitoring database	Manual	Chemical	CAS or chemical name	All monitoring data	None
1152	US EPA Resources	TSCA public use document and stakeholder input	https://www.epa.gov/assessing-and-managing-	Manual	Chemical	CAS or chemical name	Quantitative data, use information, and information in public input	None

			chemicals-under-tsca/evaluating-risk-existing-chemicals-under-tsca					
1153	US EPA Resources	TSCA Problem Formulations, Risk Assessments, and Public Comments	https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/assessments-tsca-work-plan-chemicals	Manual	Chemical	CAS or chemical name	Quantitative data, lifecycle information, production information, use information, and information in public comments	None
2001	Other US Agency Resources	National Institutes of Health (NIH) ChemIDplus	http://chem.sis.nlm.nih.gov/chemidplus/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page (with active links) PDFed	The PDF has active links, but not all links were followed and subsequently tagged
2010	Other US Agency Resources	NIH PubChem Compound Database	https://www.ncbi.nlm.nih.gov/pccompound	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page (with active links) PDFed	The PDF has active links, but not all links were followed and subsequently tagged
2018	Other US Agency Resources	NIH HazMap*	http://hazmap.nlm.nih.gov/index.html	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page (with active links) PDFed Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	The PDF has active links, but not all links were followed and subsequently tagged
2019	Other US Agency Resources	NIH Household Products Database	http://householdproducts.nlm.nih.gov/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page (with active links) PDFed	The PDF has active links, but not all links were followed and subsequently tagged
2020	Other US Agency Resources	NIH Hazardous Substance Data Bank (HSDB)*	https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page (with active links) PDFed Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	None
2021	Other US Agency Resources	NIH LACTMED	https://toxnet.nlm.nih.gov/newtoxnet/lactmed.htm	Manual	Chemical	CAS or chemical name	No results returned by search	No results returned by search
2022	Other US Agency Resources	NIH NLM Drug Information Portal	https://druginfo.nlm.nih.gov/drugportal/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and all information returned was included in zip files	None
2027	Other US Agency Resources	NTP Report on Carcinogens (RoC)	https://ntp.niehs.nih.gov/pub	Manual	Chemical	CAS or chemical name	Report on Carcinogens substance profiles	Fact sheets; scientific review documents (covered in another source)

			health/roc/index-1.html#C					
2028	Other US Agency Resources	NTP Report on Carcinogens (RoC) Supplemental Materials	https://ntp.niehs.nih.gov/pubhealth/roc/listings/index.html	Manual	Chemical	CAS or chemical name	Report on Carcinogens 2013 monograph, substance information sheets, nomination documents, and review documents	Older Report on Carcinogens monographs (2013 document is comprehensive)
2039	Other US Agency Resources	NTP Health Assessment and Translation Completed Reports	https://ntp.niehs.nih.gov/pubhealth/hat/noms/index.html	Manual	Chemical	CAS or chemical name	NTP monographs for applicable chemicals from list of all documents.	None
2100	Other US Agency Resources	CDC ATSDR Tox Profiles*	http://www.atsdr.cdc.gov/toxprofiles/index.asp	Manual	Chemical	CAS or chemical name	ATSDR tox profiles	None
2101	Other US Agency Resources	CDC ATSDR Minimal Risk Levels (MRLs) for Hazardous Substances	https://www.atsdr.cdc.gov/mrls/mrllist.asp	Manual	Chemical	CAS or chemical name	Minimum risk levels	None
2103	Other US Agency Resources	CDC ATSDR	atsdr.cdc.gov/	Automated	Chemical	ATSDR/ NIOSH	Case studies; addendums to tox profiles	Fact sheets; quantitative information already given in tox profiles; documents that do not provide quantitative data
2104	Other US Agency Resources	CDC ATSDR Health Hazard Consultations	www.atsdr.cdc.gov/hac/pha/	Automated	Chemical	ATSDR/ NIOSH	Health Hazard Consultations for the chemicals of interest	None
2111	Other US Agency Resources	CDC National Report on Human Exposure to Environmental Chemicals	cdc.gov/exposurereport/index.html	Manual	Chemical	CAS or chemical name	NHANES data summaries	None
2113	Other US Agency Resources	CDC NIOSH*	cdc.gov/niosh/	Automated	Chemical	ATSDR/ NIOSH	Documents providing quantitative data. Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	Documents captured in manual search; methods for detection (NMAM manuals); peer review articles captured in peer-reviewed literature search; draft versions of documents previously captured; letters; PowerPoint presentations for public; very high-level fact sheets and case studies; public comments; documents discussing TALC (asbestos free); case report on single occupational exposure; general lists of resources.
2115	Other US Agency Resources	CDC NIOSH*	http://www.cdc.gov/niosh/npg/npgdcas.html	Manual	Chemical	CAS or chemical name	Selected entries from list by Chemical Name and CAS number; NIOSH Pocket Guide to Chemical Hazards captured for all chemicals. Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	None

2116	Other US Agency Resources	CDC NIOSH	http://www.cdc.gov/niosh/topics/chemical.html	Manual	Chemical	CAS or chemical name	Documents from chemical-topic pages.	Methods for detection (NMAM manuals); documents captured in other NIOSH manual search; linked out documents from other government agencies.
2123	Other US Agency Resources	CDC NIOSH Health Hazard Evaluations*	https://www2a.cdc.gov/hhe/search.asp	Manual	Chemical	CAS or chemical name	Human hazard evaluation reports	Human hazard evaluation reports that do not measure chemicals of interest
2125	Other US Agency Resources	CDC NIOSH Immediately Dangerous to Life or Health	https://www.cdc.gov/niosh/idlh/intridl4.html	Manual	Chemical	CAS or chemical name	Immediately Dangerous to Life or Health summary pages captured for all chemicals, selected from list.	None
2128	Other US Agency Resources	CDC NIOHS International Chemical Safety Cards (ICSC)	https://www.cdc.gov/niosh/ipcsneng/nengcas.html	Manual	Chemical	CAS or chemical name	Searched by CAS number; International Chemical Safety Cards (ICSC) captured for all chemicals.	None
2200	Other US Agency Resources	Bureau of Labor Statistics (BLS)	bls.gov/	Automated	Chemical	Google API terms	No results returned by search	No results returned by search
2202	Other US Agency Resources	Census Bureau	census.gov	Automated	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
2204	Other US Agency Resources	Census Bureau: NAICS Determination*	http://www.census.gov/eos/www/naics/	Manual	NAICS Code	NAICS Code	Data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	None
2205	Other US Agency Resources	Census Bureau: SIC and NAICS codes	http://www.census.gov/eos/www/naics/concordances/concordances.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
2206	Other US Agency Resources	Census Bureau: Current Industrial Reports	http://www.census.gov/manufacturing/cir/index.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
2207	Other US Agency Resources	Census Bureau: Annual Survey of Manufacturers	http://www.census.gov/programs-surveys/asm.html ; http://www.census.gov/manufacturing/asm/index.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	

2208	Other US Agency Resources	Census Bureau: County Business Patterns	http://www.census.gov/programs-surveys/cbp.html ; http://www.census.gov/econ/cbp/index.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.
2210	Other US Agency Resources	Census Bureau: Data Sources for Manufacturing from the US Census Bureau	http://www.census.gov/econ/manufacturing.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.
2211	Other US Agency Resources	Census Bureau: American Housing Survey	https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html#?s_areas=a00000&s_year=n2015&s_tableName=Table1&s_byGroup1=a1&s_byGroup2=a1&s_filterGroup1=t1&s_filterGroup2=g1	Manual	None	CAS or chemical name	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.
2212	Other US Agency Resources	Census Bureau: American Community Survey	http://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2015/	Manual	None	CAS or chemical name	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.
2213	Other US Agency Resources	Census Bureau: Commodity Flow Survey	http://www.census.gov/econ/cfs/	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.
2214	Other US Agency Resources	Census Bureau: Foreign Trade	http://www.census.gov/foreign-trade/about/index.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.

2215	Other US Agency Resources	Census Bureau: Survey of Plant Capacity Utilization	http://www.census.gov/manufacturing/capacity/	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
2216	Other US Agency Resources	Census Bureau: Statistics of US Businesses	http://www.census.gov/programs-surveys/susb/data.html	Manual	NAICS Code	NAICS Code	This source will be searched once the assessment team determines the list of NAICS codes to search the database likely during problem formulation.	
2217	Other US Agency Resources	CPSC Consumer Product Safety Commission	cpsc.gov/	Automated	Chemical	Google API terms	No results returned by search	No results returned by search
2300	Other US Agency Resources	FDA Food and Drug Administration	fda.gov	Automated	Chemical	Google API terms	Chemicals of interest noted in drug labels, drug use, or other documents; guidance for industry documents; FR notices with helpful use/product information or quantitative values; Relevant GRAS notices; FDA Total Diet Study Survey results; list of prohibited chemicals for cosmetics.	Documents captured in manual search; CV of FDA researchers, FR notices with no quantitative values; documents related to drugs for mesothelioma treatment; public comments with no quantitative data; documents that state chemical measured in product, but not detected; PowerPoint presentations for public; very high-level fact sheets; citizen petition.
2301	Other US Agency Resources	FDA Databases	accessdata.fda.gov/	Automated	Chemical	Google API terms	Chemicals of interest noted in drug labels, drug use, production info or other relevant documents; FR notices with helpful use/product information or quantitative values.	Documents captured in manual search; FR notices with no quantitative values; documents discussing TALC (asbestos free); documents with no chemical-specific information; DCM mentioned as used as a solvent; methods for detection; very high-level fact sheets.
2304	Other US Agency Resources	FDA Cumulative Estimated Daily Intake	http://www.accessdata.fda.gov/scripts/sda/sdNavigation.cfm?sd=edisrev	Manual	Chemical	CAS or chemical name	Searched by CAS number; all Cumulative Estimates Daily Intakes captured for chemicals having this information.	None
2306	Other US Agency Resources	FDA Everything Added to Food in the United States (EAFUS)	http://www.fda.gov/Food/IngredientsPackagingLabeling/FoodAdditivesIngredients/ucm115326.htm	Manual	Chemical	CAS or chemical name	Database searched by CAS number; all entries captured.	None
2307	Other US Agency Resources	FDA List of Indirect Additives Used in Food Contact Substances	http://www.fda.gov/Food/IngredientsPackagingLabeling/PackagingFCS/In	Manual	Chemical	CAS or chemical name	Database searched by CAS number; all entries captured.	None

			directAdditives/ucm115333.htm					
2400	Other US Agency Resources	OSHA Occupational Safety and Health Administration	osha.gov/	Automated	Chemical	Google API terms	Regulatory limits; reports with quantitative data; data from the occupational chemical database	Detection methods papers; factsheets and evaluation guidance
2414	Other US Agency Resources	OSHA Chemical Exposure Health Data*	https://www.osha.gov/opengov/healthsamples.html	Manual	Chemical	CAS or chemical name	OSHA PELs. Additional data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	None
2502	Other US Agency Resources	NIST	NIST.gov	Automated	Chemical	Google API terms	Conference proceedings that may not be in peer-reviewed search	Peer-reviewed articles; detection method papers
2504	Other US Agency Resources	NOAA CAMEO database	https://cameochemicals.noaa.gov/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
2507	Other US Agency Resources	Protective Action Criteria (PAC) Database	https://sp.eota.energy.gov/pac/teel/search.html	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
2509	Other US Agency Resources	US Geological Survey	usgs.gov	Automated	Chemical	Google API terms	Documents providing quantitative data.	Peer reviewed papers; employee contact information;
2511	Other US Agency Resources	Department of Energy	www.energy.gov	Automated	Chemical	Google API terms	Medical Surveillance Program information and needs assessments	Fact sheets; documents containing no quantitative data
2512	Other US Agency Resources	PNNL Pacific Northwest National Laboratory	pnnl.gov/	Automated	Chemical	Google API terms	Documents providing quantitative data.	Fact sheets; employee contact information; documents that do not provide quantitative data
2513	Other US Agency Resources	US Geological Survey publications	https://pubs.er.usgs.gov/	Automated	Chemical	Google API terms	Groundwater quality data; documents containing use information or quantitative data	Peer reviewed papers; documents that do not provide quantitative data
3000	International Resources	European Commission	ec.europa.eu	Manual	Chemical	CAS or chemical name	Documents containing quantitative data or use information	Documents not containing quantitative data or use information
3005	International Resources	European Commission	eur-lex.europa.eu/collection/eu-law.html	Automated	Chemical	Google API terms	Documents containing quantitative data or use information	Documents not containing quantitative data or use information
3057	International Resources	ECHA Documents	echa.europa.eu/documents/	Manual	Chemical	CAS or chemical name	Documents containing quantitative data or use information	Documents not containing quantitative data or use information
3100	International Resources	IARC Monograph	http://monographs.iarc.fr/ENG/Monographs	Manual	Chemical	CAS or chemical name	Most-recent IARC monographs	Previous (not current) IARC monographs

			/PDFs/index.php					
3150	International Resources	OECD HPV Programme	http://webnet.oecd.org/hpv/ui/Search.aspx	Manual	Chemical	CAS or chemical name	Initial assessments, final assessments, and recommendations	None
3155	International Resources	OECD Emission Scenario Documents*	oecd.org/chemicalsafety/risk-assessment/emissionscenariodocuments.htm	Manual	NAICS Code	NAICS Code	Data supporting the lifecycle diagram/conceptual model was reviewed using professional judgment/experience.	None
3156	International Resources	OECD Substitution and Alternatives Assessment Tool Selector – Case Studies	oecdsaatoolbox.org/Home/CaseStudies	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
3200	International Resources	United Nations Environment Program (UNEP)	unep.org/	Automated	Chemical	Google API terms	No results returned by search	No results returned by search
3250	International Resources	WHO Institutional Repository for Information Sharing (IRIS)	apps.who.int/iris/	Automated	Chemical	Google API terms	Documents containing quantitative data or use information	Documents not containing quantitative data or use information
3253	International Resources	World Health Organization-Regional Office for Europe	euro.who.int/en/home	Automated	Chemical	Google API terms	None	Fact sheets
3300	International Resources	Stockholm Convention on Persistent Organic Pollutants	http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.aspx	Manual	Chemical	CAS or chemical name	Risk Profiles	None
3350	International Resources	Australian Government: Department of Health, National Industrial Chemicals; NICNAS	nicnas.gov.au/	Automated	Chemical	Google API terms	Chemical profiles; public reports with quantitative data;	Regulatory lists; fact sheets; reports with no quantitative data
3421	International Resources	Canada Chemicals Portal	chemicalsubstanceschimiques.gc.ca/index-eng.php	Manual	Chemical	CAS or chemical name	Screening assessments and general descriptions of Canada's actions on chemicals of interest	Documents not containing quantitative data or use information
3425	International Resources	Carex Canada	carexcanada.ca/en/	Automated	Chemical	Google API terms	Documents containing quantitative data or use information	Documents not containing quantitative data or use information

3450	International Resources	GESTIS Database	http://limitvalue.ifa.dguv.de/	Manual	Chemical	CAS or chemical name	Lists of international regulatory limits	None
3520	International Resources	Government of Japan: Ministry of the Environment	env.go.jp/en/	Automated	Chemical	Google API terms	Documents containing quantitative data or use information	Documents not containing quantitative data or use information
3600	International Resources	Substances in Preparations in Nordic Countries (SPIN) Database	http://www.spin2000.net/spinmyphp/	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
5000	Other Resources	Lowell Center for Sustainable Production	sustainableproduction.org	Automated	Chemical	Google API terms	Documents containing quantitative data or use information; recommendations or overall chemical summaries	Fact sheets; press releases; older versions of current reports (e.g., causes of cancer)
5011	International Resources	eChemPortal	http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
5014	Other Resources	Toxicology Excellence for Risk Assessment	http://www.tera.org/	Manual	Chemical	CAS or chemical name	Documents containing quantitative data or recommendations for analysis	Documents not containing quantitative data or recommendations for analysis
5019	Other Resources	Consumer Products Information Database (CPID)	https://www.whatsinproducts.com/chemicals/index/1	Manual	Chemical	CAS or chemical name	The database was searched by CAS number and the result page PDFed	None
5020	Other Resources	Pollution Prevention Infohouse	infohouse.p2ric.org/	Automated	Chemical	Google API terms	Documents containing quantitative data or regulatory lists of chemicals by state	Documents not containing quantitative data or regulatory lists of chemicals by state
5027	Other Resources	Kirk Othmer Encyclopedia*	Book	Manual	Chemical	CAS or chemical name	Searched by chemical name in volume index. Captured all entries pertaining to chemical of interest.	Brief mentions of chemical in entries for other chemicals not included in this search
5028	Other Resources	Ashford's Dictionary of Industrial Chemicals, 2001	Book	Manual	Chemical	CAS or chemical name	Searched by chemical name in index. Captured dictionary entries for chemical of interest.	None
5029	Other Resources	Hawley's Chemical Dictionary, 2016	Book	Manual	Chemical	CAS or chemical name	Searched by chemical name in index. Captured dictionary entries for chemical of interest.	None
6000	States	Custom search engine using States sites (see separate table)	multiple	Automated	Chemical	States	Documents containing quantitative data or regulatory lists of chemicals by state	Documents not containing quantitative data or regulatory lists of chemicals by state, including fact sheets
7141	Trade/ Professional	American Composites Manufacturers Association	www.acmanet.org	Automated	Chemical	Google API terms	Trade association websites were searched by search strings containing CAS number and common chemical synonyms. If a search result	Documents such as news releases that do not contain quantitative data beyond general use information. Documents describing analytical

7142	Trade/ Professional	Aerospace Industries Association of America	www.aia-aerospace.org	Automated	Chemical	Google API terms	was a pdf file it was captured automatically, otherwise a webpage with active links was captured. On-topic documents included industrial processes and uses, production and trade data, court proceedings, regulatory response from industry, and regulatory guidance documents.	processes where chemical was used in apparatus, reagent, or reference material. Documents describing non-current use such as pre 1980 uses of asbestos. Documents describing alternative use compounds to the chemical being searched.
7144	Trade/ Professional	American Chemistry Council	www.americanchemistry.com	Automated	Chemical	Trade association terms		
7146	Trade/ Professional	Asphalt Roofing Manufacturers Association	www.asphaltroofing.org	Automated	Chemical	Trade association terms		
7153	Trade/ Professional	Chemistry Industry Association of Canada	www.canadianchemistry.ca	Automated	Chemical	Trade association terms		
7156	Trade/ Professional	European Flame Retardant Association	www.cefic-efra.com	Automated	Chemical	Trade association terms		
7159	Trade/ Professional	Consumer Specialty Products Association	www.cspa.org	Automated	Chemical	Trade association terms		
7163	Trade/ Professional	European Brominated Flame Retardant Industry Panel	www.ebfrip.org	Automated	Chemical	Trade association terms		
7172	Trade/ Professional	Juvenile Products Manufacturers Association	www.jpma.org	Automated	Chemical	Trade association terms		
7176	Trade/ Professional	National Association of Manufacturers	www.nam.org	Automated	Chemical	Trade association terms		
7200	Trade/ Professional	Phosphorous, Inorganic, & Nitrogen Flame Retardants Association	www.pinfa.org	Automated	Chemical	Trade association terms		
7201	Trade/ Professional	Plastic Pipes Institute	www.plasticpipe.org	Automated	Chemical	Trade association terms		
7209	Trade/ Professional	Structural Insulated Panel Association	www.sips.org	Automated	Chemical	Trade association terms		
7210	Trade/ Professional	Society of Chemical Manufacturers and Affiliates	www.socma.com	Automated	Chemical	Trade association terms		
7224	Trade/ Professional	American Composites Manufacturers Association	www.acmanet.org	Automated	Chemical	Trade association terms		
7233	Trade/ Professional	American Fiber Manufacturers Association	www.afma.org	Automated	Chemical	Trade association terms		

7235	Trade/ Professional	American Foundry Society	www.afsinc.org	Automated	Chemical	Trade association terms		
7237	Trade/ Professional	American Gas Association	www.aga.org	Automated	Chemical	Trade association terms		
7242	Trade/ Professional	Air-Conditioning, Heating, & Refrigeration Institute	www.ahrinet.org	Automated	Chemical	Trade association terms		
7245	Trade/ Professional	Aluminum Association	www.aluminum.org	Automated	Chemical	Trade association terms		
7247	Trade/ Professional	Association for Manufacturing Excellence	www.ame.org	Automated	Chemical	Trade association terms		
7250	Trade/ Professional	American Chemistry Council	www.americanchemistry.com	Automated	Chemical	Trade association terms		
7254	Trade/ Professional	American National Standards Institute	www.ansi.org	Automated	Chemical	Trade association terms		
7256	Trade/ Professional	American Petroleum Institute	www.api.org	Automated	Chemical	Trade association terms		
7260	Trade/ Professional	The Adhesive and Sealant Council	www.ascouncil.org	Automated	Chemical	Trade association terms		
7266	Trade/ Professional	American Wood Council	www.awc.org	Automated	Chemical	Trade association terms		
7274	Trade/ Professional	Business & Institutional Furniture Mfrs Association	www.bifma.org	Automated	Chemical	Trade association terms		
7281	Trade/ Professional	Can Manufacturers Institute	www.cancentral.com	Automated	Chemical	Trade association terms		
7295	Trade/ Professional	European Chlorinated Solvents Association	www.chlorinated-solvents.eu	Automated	Chemical	Trade association terms		
7298	Trade/ Professional	Council of Industrial Boiler Owners	www.cibo.org	Automated	Chemical	Trade association terms		
7300	Trade/ Professional	American Cleaning Institute	www.cleaninginstitute.org	Automated	Chemical	Trade association terms		

7304	Trade/ Professional	Copper Development Association Inc	www.copper.org	Automated	Chemical	Trade association terms		
7308	Trade/ Professional	Consumer Specialty Products Association	www.cspa.org	Automated	Chemical	Trade association terms		
7346	Trade/ Professional	Flexible Packaging Association	www.flexpack.org	Automated	Chemical	Trade association terms		
7354	Trade/ Professional	Gasket Fabricators Association	www.gasketfab.com	Automated	Chemical	Trade association terms		
7358	Trade/ Professional	Global Automakers	www.globalautomakers.org	Automated	Chemical	Trade association terms		
7359	Trade/ Professional	Grocery Manufacturers Association	www.gmaonline.org	Automated	Chemical	Trade association terms		
7374	Trade/ Professional	Halogenated Solvents Industry Alliance, Inc. (HSIA)	www.hsia.org	Automated	Chemical	Trade association terms		
7382	Trade/ Professional	Independent Lubricant Manufacturers Association	www.ilma.org	Automated	Chemical	Trade association terms		
7386	Trade/ Professional	Association of Nonwoven Fabrics Industry	www.inda.org	Automated	Chemical	Trade association terms		
7392	Trade/ Professional	Association Connecting Electronics Industries	www.ipc.org	Automated	Chemical	Trade association terms		
7395	Trade/ Professional	Institute of Scrap Recycling Industries	www.isri.org	Automated	Chemical	Trade association terms		
7396	Trade/ Professional	The Worldwide Cleaning Industry Association	www.issa.com	Automated	Chemical	Trade association terms		
7398	Trade/ Professional	Juvenile Products Manufacturers Association	www.jpma.org	Automated	Chemical	Trade association terms		
7419	Trade/ Professional	Motor & Equipment Manufacturers Association	www.mema.org	Automated	Chemical	Trade association terms		
7433	Trade/ Professional	National Association for Surface Finishing	www.nasf.org	Automated	Chemical	Trade association terms		

7440	Trade/ Professional	National Electrical Manufacturers Association	www.nema.org	Automated	Chemical	Trade association terms		
7444	Trade/ Professional	Natural Gas Supply Association	www.ngsa.org	Automated	Chemical	Trade association terms		
7453	Trade/ Professional	N-Methylpyrrolidone Producers Group, Inc.	www.nmpgroup.com	Automated	Chemical	Trade association terms		
7471	Trade/ Professional	Petroleum Equipment Institute	www.pei.org	Automated	Chemical	Trade association terms		
7473	Trade/ Professional	Personal Care Products Council	www.personalcarecouncil.org	Automated	Chemical	Trade association terms		
7483	Trade/ Professional	Precision Machined Products Association	www.pmpa.org	Automated	Chemical	Trade association terms		
7485	Trade/ Professional	Power Tool Institute, Inc.	www.powertoolinstitute.com	Automated	Chemical	Trade association terms		
7489	Trade/ Professional	Printing Industries of America	www.printing.org	Automated	Chemical	Trade association terms		
7490	Trade/ Professional	Pressure Sensitive Tape Council	www.pstc.org	Automated	Chemical	Trade association terms		
7498	Trade/ Professional	Roof Coatings Manufacturers Association	www.roofcoatings.org	Automated	Chemical	Trade association terms		
7502	Trade/ Professional	Specialty Equipment Market Association	www.sema.org	Automated	Chemical	Trade association terms		
7511	Trade/ Professional	Society of Manufacturing Engineers	www.sme.org	Automated	Chemical	Trade association terms		
7513	Trade/ Professional	Society of Chemical Manufacturers & Affiliates	www.socma.com	Automated	Chemical	Trade association terms		
7516	Trade/ Professional	SteelWorks	www.steel.org	Automated	Chemical	Trade association terms		
7520	Trade/ Professional	Textile Care Allied Trades Association	www.tcata.org	Automated	Chemical	Trade association terms		

7531	Trade/ Professional	Textile Rental Services Association of America	www.trsa.org	Automated	Chemical	Trade association terms		
7541	Trade/ Professional	Vinyl Siding Institute	www.vinylsiding.org	Automated	Chemical	Trade association terms		
7554	Trade/ Professional	Extruded Polystyrene Foam Association	www.xpsa.com	Automated	Chemical	Trade association terms		

* Asterisk denotes sources that were part of the lifecycle/conceptual model search.

[1] See Table_Apx C-1 for list of search terms and keywords

Table_Apx C-3. List of State Websites Included in the "States" Search for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard Topic Areas

State	Type	Title	URL
Alabama	Environment	Alabama Department of Environmental Management	www.adem.state.al.us
Alabama	Occupational Health	Alabama Occupational Safety and Health	www.labor.alabama.gov
Alabama	Environmental Health/Health	Environmental - Home - Alabama Department of Public Health	www.adph.org/environmental
Alaska	Environment	Alaska Department of Environmental Conservation - State of Alaska	www.dec.alaska.gov
Alaska	Environment	Environment - Environment Alaska	www.environmentalaska.us
Alaska	Occupational Health	Alaska Occupational Safety and Health Section - Alaska Department ...	www.labor.state.ak.us/lss/oshhome.htm
Arizona	Environment	ADEQ Arizona Department of Environmental Quality | Our mission is ...	www.azdeq.gov
Arizona	Occupational Health	ADOSH Main Page | Industrial Commission of Arizona	www.azica.gov/our-organization/adosh
Arizona	Environmental Health/Health	Arizona Department of Health Services	www.azdhs.gov
Arizona	Environmental Health/Health	ADEQ Arizona Department of Environmental Quality | Our mission is ...	www.azdeq.gov
Arizona	Environmental Health/Health	Arizona Children's Environmental Health Program	www.legacy.azdeq.gov/ceh/
Arkansas	Environment	Arkansas Department of Environmental Quality (ADEQ)	www.adeq.state.ar.us
Arkansas	Occupational Health	Occupational Health and Safety Compliance Program	www.labor.arkansas.gov/occupational-safety-and-health-compliance-program-aosh
Arkansas	Environmental Health/Health	ADH: Environmental Health - Arkansas Department of Health	www.healthy.arkansas.gov
California	Environment	California Environmental Protection Agency: CalEPA	www.calepa.ca.gov
California	Environment	California Department of Conservation	www.conservation.ca.gov
California	Environment	California Department of Toxic Substances Control	www.dtsc.ca.gov
California	Occupational Health	Occupational Health Branch main page - California Department of ...	www.cdph.ca.gov
California	Occupational Health	Cal/OSHA - Division of Occupational Safety and Health - Home Page	www.dir.ca.gov/dosh
California	Environmental Health/Health	Biomonitoring California	www.biomonitoring.ca.gov
California	Environmental Health/Health	Office of Environmental Health Hazard Assessment	www.oehha.ca.gov
California	Environmental Health/Health	Department of Public Health: Environmental Health	www.cdph.ca.gov/programs/Pages/CenterEnvironmentalHealth.aspx
Colorado	Environmental Health/Health	Colorado Department of Public Health and Environment	www.cdphe.state.co.us
Connecticut	Environment	Connecticut Department of Energy & Environmental Protection	www.ct.gov/dep/
Connecticut	Occupational Health	DPH: Occupational Health Unit - CT.gov	www.ct.gov/dph/occupationalhealth

Connecticut	Occupational Health	Occupational Safety & Health (CONN-OSHA) - State of Connecticut ...	www.ctdol.state.ct.us/osha/osha.htm
Connecticut	Environmental Health/Health	Department of Public Health: Environmental Health	www.ct.gov/dph/
Delaware	Environment	Delaware Department of Natural Resources and Environmental ...	www.dnrec.state.de.us
Delaware	Environment	State of Delaware - Topics - Environment	www.delaware.gov/topics/environment
Delaware	Occupational Health	Delaware Office of Occupational Health	www.dhss.delaware.gov/dph/hsp/oh.html
Delaware	Environmental Health/Health	Division of Public Health - Delaware Health and Social Services ...	www.dhss.delaware.gov/dhss/dph/
Florida	Environment	Welcome | Florida Department of Environmental Protection (DEP)	www.dep.state.fl.us
Florida	Environmental Health/Health	Environmental Health	www.floridahealth.gov/environmental-health/
Georgia	Environment	Environmental Protection Division | A Division of the Georgia ...	www.epd.georgia.gov
Georgia	Occupational Health	Georgia Occupational Health and Safety Surveillance Program ...	www.dph.georgia.gov/georgia-occupational-health-and-safety-surveillance-program
Georgia	Environmental Health/Health	Environmental Health | Georgia Department of Public Health	www.dph.georgia.gov/environmental-health
Hawaii	Environment	Office of Environmental Quality Control (OEQC) - Hawaii Department ...	www.health.hawaii.gov
Hawaii	Occupational Health	Hawaii Occupational Safety and Health - Department of Labor and ...	www.labor.hawaii.gov
Hawaii	Environmental Health/Health	Hawaii Environmental Health Portal	www.eha-cloud.doh.hawaii.gov
Idaho	Environment	Idaho Department of Environmental Quality: Home	www.deq.idaho.gov
Idaho	Environmental Health/Health	Environmental Health - Idaho Department of Health and Welfare	www.healthandwelfare.idaho.gov
Illinois	Environment	Illinois Environmental Protection Agency	www.epa.illinois.gov
Illinois	Occupational Health	Illinois OSHA: Illinois OSHA	www.osha.illinois.gov
Illinois	Environmental Health/Health	Illinois Department of Public Health	www.www.idph.state.il.us
Indiana	Environment	Indiana Department of Environmental Management - IN.gov	www.in.gov/idem/
Indiana	Occupational Health	IOSHA - IN.gov	www.in.gov/dol/iosha.htm
Indiana	Environmental Health/Health	Indiana Environmental Health Website	www.in.gov/isdh
Iowa	Environment	Environmental Protection - Iowa Department of Natural Resources	www.iowadnr.gov
Iowa	Occupational Health	Iowa OSHA | www.iowadivisionoflabor.gov	www.iowaosha.gov
Iowa	Environmental Health/Health	EHS - Home - Iowa Department of Public Health - Iowa.gov	www.idph.iowa.gov/ehs
Kansas	Environment	Kansas Department of Health & Environment: Division of Environment	www.kdheks.gov/environment/
Kansas	Occupational Health	Kansas Department of Labor: workplace safety	www.dol.ks.gov/Safety
Kansas	Environmental Health/Health	Kansas Department of Health & Environment: Division of Public Health	www.kdheks.gov

Kentucky	Environment	Department for Environmental Protection | Welcome - Kentucky.gov	www.dep.ky.gov
Kentucky	Environment	Kentucky Environmental Quality Commission | Welcome to the EQC	www.eqc.ky.gov
Kentucky	Environment	Energy and Environment Cabinet | Welcome - Kentucky.gov	www.eec.ky.gov
Kentucky	Occupational Health	Kentucky Labor Cabinet - Occupational Safety and Health Program	www.labor.ky.gov/dows/oshp/Pages/Occupational-Safety-and-Health-Program.aspx
Kentucky	Environmental Health/Health	Kentucky: Cabinet for Health and Family Services - DPH Home	www.chfs.ky.gov/dph/
Louisiana	Environment	Louisiana Department of Environmental Quality > HOME	www.deq.louisiana.gov
Louisiana	Environmental Health/Health	About Environmental Health - Louisiana Department of Health and ...	www.dhh.louisiana.gov
Louisiana	Environmental Health/Health	Health Data Portal	www.healthdata.dhh.la.gov
Maine	Environment	Maine Department of Environmental Protection (DEP) - Maine.gov	www.maine.gov/dep/
Maine	Occupational Health	Maine Department of Labor: Workplace Safety and Health - Maine.gov	www.maine.gov/labor/workplace_safety/
Maine	Environmental Health/Health	Division of Environmental Health - Maine CDC: DHHS ... - Maine.gov	www.maine.gov/dhhs/mecdc/environmental-health/el/
Maine	Environmental Health/Health	Maine DHHS - Environmental Health - Maine.gov	www.maine.gov/dhhs/environmental_health.shtml
Maryland	Environment	Maryland Department of the Environment	www.mde.state.md.us
Maryland	Occupational Health	Maryland Occupational Safety and Health (MOSH) - Division of ...	www.dllr.state.md.us
Maryland	Environmental Health/Health	Environmental Health - Maryland Department of Health and Mental ...	www.dhmh.maryland.gov
Maryland	Environmental Health/Health	Environmental Health - Prevention and Health Promotion ...	www.phpa.dhmh.maryland.gov
Massachusetts	Environment	Massachusetts Department of Environmental Protection | MassDEP	www.mass.gov/eea/agencies/massdep/
Massachusetts	Occupational Health	Occupational Health Surveillance Program - Mass.Gov	www.mass.gov/dph/ohsp
Massachusetts	Environmental Health/Health	Environmental Health - Mass.Gov	www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/
Michigan	Environment	DEQ - Department of Environmental Quality - State of Michigan	www.michigan.gov/deq/
Michigan	Occupational Health	MI Occupational Safety & Health Administration - State of Michigan	www.michigan.gov/lara/
Michigan	Environmental Health/Health	MDHHS - Public Safety & Environmental Health - State of Michigan	www.michigan.gov/mdhhs/
Minnesota	Environment	Minnesota Pollution Control Agency	www.pca.state.mn.us
Minnesota	Environment	Minnesota Environmental Quality Board	www.eqb.state.mn.us
Minnesota	Occupational Health	Minnesota Center for Occupational Health and Safety	www.health.state.mn.us/occhealth/
Minnesota	Environmental Health/Health	Environmental Health - Minnesota Dept. of Health	www.health.state.mn.us
Minnesota	Environmental Health/Health	Environmental Safety - Minnesota.gov	www.mn.gov/portal/health-and-safety/environmental-safety/
Mississippi	Environment	Mississippi Department of Environmental Quality	www.deq.state.ms.us

Mississippi	Occupational Health	Occupational Health - Mississippi State Department of Health	www.msdh.ms.gov
Missouri	Environment	Division of Environmental Quality - Missouri Department of Natural ...	www.dnr.mo.gov/env
Missouri	Occupational Health	Workplace Safety | Missouri Labor	www.labor.mo.gov/DLS/workplaceSafety
Missouri	Environmental Health/Health	Environmental Health Operational Guidelines | Missouri Department ...	www.health.mo.gov
Missouri	Environmental Health/Health	Missouri Environmental Public Health Tracking	www.ephtn.dhss.mo.gov
Missouri	Environmental Health/Health	Environmental Public Health	www.kcmo.gov/health/environmental-health-services/e
Montana	Environment	Air - Montana DEQ > Home - Montana.gov	www.deq.mt.gov
Montana	Occupational Health	Occupational Safety and Health - Employment Relations Division	www.erd.dli.mt.gov/safety-health/occupational-safety-and-health
Montana	Environmental Health/Health	Environmental Health - DPHHS Home - Montana.gov	www.dphhs.mt.gov/publichealth/Environmental-Health
Nebraska	Environment	Nebraska Department of Environmental Quality	www.deq.state.ne.us
Nebraska	Occupational Health	Department of Labor Office of Safety	www.dol.nebraska.gov/Safety/
Nebraska	Environmental Health/Health	Nebraska DHHS: Environmental Health	www.dhhs.ne.gov
Nevada	Environment	Nevada Division of Environmental Protection	www.ndep.nv.gov
Nevada	Occupational Health	Department of Industrial Relations, OSHA	www.dir.nv.gov/OSHA/Home/
Nevada	Environmental Health/Health	Nevada Division of Public and Behavioral Health - State of Nevada, Environmental Health Section	www.dpbh.nv.gov
New Hampshire	Environment	Welcome | NH Department of Environmental Services	www.des.nh.gov
New Hampshire	Environment	Environmental Protection Bureau | NH Department of Justice	www.doj.nh.gov/environmental-protection/index.htm
New Hampshire	Occupational Health	Occupational Health Surveillance Program at University of New Hampshire, in conjunction with the state	www.iod.unh.edu/projects/occupational-health-surveillance-program
New Hampshire	Environmental Health/Health	Welcome | New Hampshire Environmental Public Health Tracking Program	www.nh.gov/epht
New Jersey	Environment	NJDEP New Jersey Department of Environmental Protection	www.nj.gov/dep
New Jersey	Occupational Health and Environmental Health	Department of Health, The Consumer, Environmental and Occupational Health Service	www.nj.gov/health/ceohs/
New Mexico	Environment	New Mexico Environment Department Home Web Site Homepage ...	www.env.nm.gov
New York	Environment	New York State Department of Environmental Conservation	www.dec.ny.gov
New York	Occupational Health	NYS Occupational Health Clinic Network - New York State ...	www.health.ny.gov/environmental/workplace/
North Carolina	Environment	NC DEQ	www.deq.nc.gov
North Carolina	Occupational Health	N.C. Department of Labor, Occupational Health Division	www.nclabor.com/osha/

North Carolina	Environmental Health/Health	State of North Carolina: Environmental Health	www.nc.gov/agency/environmental-health
North Dakota	Environment	Environmental Services - nd.gov: Official Portal for North Dakota ...	www.nd.gov
North Dakota	Environment	Environmental and Transportation Services Division - North Dakota ...	www.dot.nd.gov/public/divdist/environmental.htm
North Dakota	Environmental Health/Health	Environmental Health Air Quality Section	www.ndhealth.gov/aq/
North Dakota	Environmental Health/Health	Environmental Health Section - North Dakota Department of Health	www.ndhealth.gov/ehs/
Ohio	Environment	Ohio EPA Home	www.epa.state.oh.us
Ohio	Occupational Health	Ohio Bureau of Workers Compensation, Division of Safety & Hygiene services	www.bwc.ohio.gov/employer/programs/safety/
Ohio	Environmental Health/Health	Environmental Health - Ohio Department of Health	www.odh.ohio.gov/environmentalhealth
Oklahoma	Environment	Welcome to the Oklahoma Department of Environmental Quality	www.deq.state.ok.us
Oklahoma	Occupational Health	Oklahoma Department of Labor - Safety and Health (PEOSH)	www.ok.gov/odol/Services/Safety_and_Health_(PEOSH)
Oregon	Environment	State of Oregon: Department of Environmental Quality - Home	www.oregon.gov/DEQ/
Oregon	Occupational Health	State of Oregon: Oregon OSHA - Home	www.osha.oregon.gov
Oregon	Environmental Health/Health	Healthy Environments - Oregon Public Health Division - Oregon.gov	www.public.health.oregon.gov/HealthyEnvironments
Pennsylvania	Environment	Pennsylvania Department of Environmental Protection	www.dep.pa.gov
Pennsylvania	Occupational Health	Occupational and Industrial Safety - PA Department of Labor ...	www.dli.pa.gov/Individuals/Labor-Management-Relations/bois/Pages/default.aspx
Pennsylvania	Environmental Health/Health	Pennsylvania Department of Health	www.health.pa.gov/My%20Health/Environmental%20Health/Pages/default.aspx#.WLdHiW_ytJ8
Rhode Island	Environment	Home- Rhode Island -Department of Environmental Management	www.dem.ri.gov
Rhode Island	Occupational Health	Occupational Safety, Workforce Regulation and Safety, RI ...	www.dlt.ri.gov/occusafe/
Rhode Island	Environmental Health/Health	Environmental Health, Division of - Rhode Island Department of Health	www.health.ri.gov/programs/detail.php?pgm_id=1052
South Dakota	Environment	South Dakota Department of Environment and Natural Resources	www.denr.sd.gov
South Dakota	Environmental Health/Health	South Dakota Environmental Health Laboratory	www.doh.sd.gov/lab/environmental/
South Carolina	Environment	Environment - SC.gov	www.sc.gov/HealthAndSafety/Pages/Environment.aspx
South Carolina	Occupational Health	South Carolina Occupational Safety and Health Administration	www.scosha.llronline.com/
South Carolina	Environmental Health/Health	S.C. Department of Health & Environmental Control	www.scdhec.gov

Tennessee	Environment	Department of Environment & Conservation - State of Tennessee	www.tennessee.gov/environment/
Tennessee	Environment	Division of Water Resources - TN.Gov	www.tn.gov/environment/section/wr-water-resources
Tennessee	Occupational Health	Tennessee Occupational Safety and Health Administration - TN.Gov	www.tn.gov/workforce/section/tosha
Tennessee	Environmental Health/Health	Tennessee Department of Health - TN.Gov	www.tn.gov/health/section/eh
Texas	Environment	TCEQ Homepage - TCEQ - www.tceq.texas.gov	www.tceq.texas.gov
Texas	Occupational Health	OSHA - Workplace Safety and Health Requirements	www.twc.state.tx.us
Texas	Occupational Health	OSHCON: Occupational Safety and Health Consultation Program	www.tdi.texas.gov
Texas	Environmental Health/Health	Texas Department of State Health Services, Texas Environmental Health Institute	www.dshs.texas.gov
Utah	Environment	Utah Department of Environmental Quality	www.deq.utah.gov
Utah	Environment	Utah DEQ: Division of Air Quality	www.airquality.utah.gov
Utah	Occupational Health	Utah Occupational Safety and Health	www.laborcommission.utah.gov/divisions/UOSH/
Utah	Environmental Health/Health	UT-EPHT - Welcome to Utah's Environmental Public Health Tracking ...	www.epht.health.utah.gov
Vermont	Environment	Vermont Department of Environmental Conservation	www.dec.vermont.gov
Vermont	Environment	Department of Environmental Conservation - Vermont Agency of ...	www.anr.vermont.gov
Vermont	Occupational Health	VOSHA | Vermont Department of Labor	www.labor.vermont.gov
Vermont	Environmental Health/Health	Vermont Department of Health	www.healthvermont.gov
Vermont	Environmental Health/Health	Vermont Department of Health	www.han.vermont.gov
Virginia	Environment	The Virginia Department of Environmental Quality: Virginia DEQ	www.deq.virginia.gov
Virginia	Occupational Health	Office of Occupational Safety and Health Home	www.va.gov/vasafety
Virginia	Environmental Health/Health	Virginia Department of Health	www.vdh.virginia.gov
Washington	Environment	Access Washington - Environment	www.access.wa.gov/topics/environment
Washington	Environment	Washington State Department of Ecology	www.ecy.wa.gov
Washington	Occupational Health	Department of Labor and Industries: Centers of Occupational Health and Education	www.cohe.lni.wa.gov
Washington	Environmental Health/Health	Environmental Public Health :: Washington State Department of Health	www.doh.wa.gov
West Virginia	Environment	WV Department of Environmental Protection	www.dep.wv.gov
West Virginia	Environmental Health/Health	Welcome to the Bureau for Public Health - West Virginia Department ...	www.dhhr.wv.gov/bph
Wisconsin	Environment	The State of Wisconsin's Environment - Wisconsin Department of ...	www.dnr.wi.gov

Wisconsin	Occupational Health	Wisconsin Occupational Health Program | Wisconsin Department of ...	www.dhs.wisconsin.gov/occupational-health/
Wisconsin	Environmental Health/Health		www.dhs.wisconsin.gov/environmental/
Wyoming	Environment	DEQ Wyoming Department of Environmental Quality	www.deq.state.wy.us
Wyoming	Environment	Air Quality | Wyoming Department of Environmental Quality	www.deq.wyoming.gov
Wyoming	Occupational Health		www.wyomingworkforce.org/businesses/osha/
Wyoming	Environmental Health/Health	Wyoming Department of Health: Home Page	www.health.wyo.gov

Table_Apx C-4. List of Gray Literature Sources Removed from Search During Curation for Fate, Engineering/Occupational Exposure, Exposure, and Human Health Hazard Topic Areas

Searched ID	Description	URL	Reason
1007	Office of Water Effluent Guidelines	https://www.epa.gov/eg	Provides a list of chemicals only
1009	Water Quality Criteria 1986		Outdated
1018	Government Publishing Office (GPO)	https://www.gpo.gov/	Search this last because most hits will be duplicates
1077	Greener products and services	https://www.epa.gov/greenerproducts/identify-greener-products-and-services	Public fact sheets without sufficient level of detail
1089	ECOTOX Database	https://cfpub.epa.gov/ecotox/quick_query.htm	Removed because ecotox team is covering this reference
1121	US EPA Resources	Fact Sheets	Public fact sheets without sufficient level of detail
1123	EPA Reports	Search epa.gov for each chemical with the key word "report"; only keep those that wouldn't be caught by other sources	Other searches caught this information
1125	EPA Manufacturing/Use	Search epa.gov for each manufacturing sector and use and key words "fact sheet" or "report"	Other searches caught this information
1130	Substance Registry Services (SRS)	https://iaspub.epa.gov/sor_internet/registry/substreg/searchandretrieve/substancesearch/search.do	Site provides links to other trusted sources; was used to ensure no part of SRS was excluded from overall trusted source list
1142	EPA Existing Chemicals Engineering Files	EPA has an archive of hardcopy engineering assessments from previous Existing Chemicals assessments. If directed by the EPA Task Manager, ERG will contact the EPA WA COR to inquire as to the location of these hardcopy files and will review them for relevant information.	This information is internal to OPPT and not public; it may be searched in the future
2023	NTP National Toxicology Program	ntp.niehs.nih.gov/	Too general; refined search strategy to target specific subsites
2024	NTP National Toxicology Program - Search	http://ntpsearch.niehs.nih.gov/	Too general; refined search strategy to target specific subsites
2025	NTP National Toxicology Program - Substances studied by NTP	https://ntp.niehs.nih.gov/testing/status/agents/ts-11297-e.html	All NTP studies are captured in Toxline
2033	NTP Genetically Modified Model Report Series	https://ntp.niehs.nih.gov/testing/types/altmodels/reports/index.html	All NTP studies are captured in Toxline
2034	NTP Technical Report Series	https://ntp.niehs.nih.gov/results/pubs/longterm/reports/longterm/index.html	All NTP studies are captured in Toxline
2035	NTP Toxicity Report Series	https://ntp.niehs.nih.gov/results/pubs/shortterm/reports/index.html	All NTP studies are captured in Toxline

2036	NTP Developmental Toxicity Study Abstracts	https://ntp.niehs.nih.gov/testing/types/dev/abstracts/index.html	All NTP studies are captured in Toxline
2037	NTP Immunotoxicity Study Abstracts	https://ntp.niehs.nih.gov/testing/types/imm/abstracts/index.html	All NTP studies are captured in Toxline
2038	NTP Reproductive Assessment by Continuous Breeding Study Abstracts	https://ntp.niehs.nih.gov/testing/types/repro/abstracts/index.html	All NTP studies are captured in Toxline
2040	NTP- Chemical Effects in Biological Systems (CEBS) database	https://tools.niehs.nih.gov/cebs3/ui/	All NTP studies are captured in Toxline
2102	CDC ATSDR Public Health Statements	https://www.atsdr.cdc.gov/phs/phs.asp?id=953&tid=199	Already covered by the ATSDR tox profiles in ID 2100
2112	CDC NHANES	https://www.cdc.gov/nchs/nhanes/	Other searches caught this information
2124	CDC NIOSH	https://www.cdc.gov/niosh/	A targeted NIOSH search was done instead
2126	CDC NIOSH Pocket Guide to Chemical Hazards	https://www.cdc.gov/niosh/npg/search.html	Already covered under ID 2116 (Pocket guide to chemical hazards)
2201	Bureau of Labor Statistics: American Time Use Survey	https://www.bls.gov/tus/tables.htm	Does not provide chemical-specific information and is already incorporated into OPPT generic exposure scenarios
2209	Census Bureau: American Fact Finder Database	https://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t	Does not provide chemical-specific information and is already incorporated into OPPT generic exposure scenarios
2225	Electronic Code of Federal Regulations	http://www.ecfr.gov/	This provides regulatory information only
2401	OSHA Permissible Exposure Limits Table Z-1	https://www.osha.gov/dsg/annotated-pels/tablez-1.html	Other searches caught this information
2402	OSHA Permissible Exposure Limits Table Z-2	https://www.osha.gov/dsg/annotated-pels/tablez-2.html	Other searches caught this information
2403	OSHA Permissible Exposure Limits Table Z-3	https://www.osha.gov/dsg/annotated-pels/tablez-3.html	Other searches caught this information
2503	NOAA National Oceanic and Atmospheric Administration	www.noaa.gov	Data provided in cameo database already
2508	US International Trade Commission	https://www.usitc.gov/	Provides export information, which is not on topic for this search
2510	USGS US Geological Survey, National Water Information System	http://waterdata.usgs.gov/nwis	Included in EPA OPPT monitoring database
2511	CDC National Report on Human Exposure to Environmental Chemicals	cdc.gov/exposurereport/index.html	Moved from automated to manual search

3050	ECHA	echa.europa.eu/	Too general; refined search strategy to target specific subsites
3056	Japan NITE CHEmicals Collaborative Knowledge database	http://www.safe.nite.go.jp/jcheck/search.action?request_locale=en	Other searches caught this information
3075	International Resources	https://echa.europa.eu/registration-dossier/	Other searches caught this information
3149	OECD	http://webnet.oecd.org/CCRWEB/Search.aspx	This is captured by the echemportal.org site which also provides record for Japan, Finland, Australia, The Netherlands
3154	OECD eChemPortal	http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en	This is a duplicate
3255	WHO International Program on Chemical Safety (UN)	http://www.who.int/ipcs/en/	These data appear in inchem, which is in echemportal
3400	Environment Canada	http://www.ec.gc.ca/default.asp?lang=En&n=FD9B0E51-1	Chemical Substances page links to relevant pages at this site
3411	Health Canada	http://www.hc-sc.gc.ca/index-eng.php	Chemical Substances page links to relevant pages at this site
3430	Government of Alberta, Canada	http://work.alberta.ca	Other provinces were not searched, so this was eliminated for consistency
3500	Japan Chemical Risk Information Platform (CHIRP)	http://www.nite.go.jp/en/chem/chrip/chrip_search/systemTop	Other searches caught this information
5002	Toxic Use Reduction Institute	http://www.turi.org	Links back to regulatory documents captured in other sources
5005	Environmental Fate Database (EFDB)	http://www.srcinc.com/what-we-do/efdb.aspx	No longer exists
5004	SRI International	-	Paid access to market reports only
5006	SRC FatePointers Search Module PHYSPROP	http://esc.syrres.com/fatepointer/search.asp	Provides information captured in other sources
5010	ChemSpider	http://www.chemspider.com	Not needed since we have chemidplus
5012	inchem	inchem.org	Captured in 5011 results echemportal
5015	ITER	iter.ctc.com/publicURL/pub_search_list.cfm	Provides information captured in other sources
5017	Global Science Gateway	http://www.worldwidescience.org	Other searches caught this information
5018	Cambridge University	http://www-jmg.ch.cam.ac.uk/cil/SGTL/database/	Access only granted to Cambridge researchers and students
5022	Lowell Center for Sustainable Production	http://www.chemicalspolicy.org/chemicalspolicy.us.state.database.php	Only provides regulatory information
5023	ACGIH	Search the ACGIH handbook to determine whether ACGIH Threshold Limit Value (TLV) has been established for specific chemicals of interest	Only provides regulatory information

5024	Pollution Prevention Reference Manual	http://infohouse.p2ric.org/	Other searches caught this information
7264	ASTM International	www.astm.org	Paid access to standard methods only
7381	IHS Market	www.ihs.org	Paid access to market reports only
7467	American Coatings Association	www.paint.org	Documents restricted to members only
	Regulations.gov	regulations.gov	Assumed that technical support documents will be caught using other methods
	Federal Register	www.federalregister.gov	Assumed that technical support documents will be caught using other methods

D. LITERATURE SEARCHES FOR ENVIRONMENTAL HAZARD

The sources searched in the environmental hazard literature search are provided in Table_Apx D-1. The specific search strategies are provided in the remainder of Appendix D.

Table_Apx D-1. Sources Used For Gray Literature Search for the Ecotoxicity Topic Area

Trusted Source Category	Source	Manual or Automated?	Searched By:	Keywords	Source Address
Other US Agencies	eChemPortal	Manual	Chemical	CAS Number or chemical name	http://www.echemportal.org/echemportal/participant/page.action?pageID=9
International Resources	OECD HPV/SIDS/IUCLID	Manual	Chemical	CAS Number or chemical name	http://webnet.oecd.org/hpv/ui/Search.aspx
International Resources	ECHA information on Registered Substances	Manual	Chemical	CAS Number or chemical name	http://echa.europa.eu/information-on-chemicals/registered-substances
International Resources	ECHA Information from the Existing Substances Regulation (ESR)	Manual	Chemical	CAS Number or chemical name	http://echa.europa.eu/information-on-chemicals/information-from-existing-substances-regulation
International Resources	Environment Canada	Manual	Chemical	CAS Number or chemical name	http://www.ec.gc.ca/default.asp?lang=En&n=ECD35C36
International Resources	Environment Canada: Toxic Substances Managed Under CEPA	Manual	Chemical	CAS Number or chemical name	http://www.ec.gc.ca/toxiques-toxics/Default.asp?lang=En&n=98E80CC6-1
International Resources	Environment Canada: Draft and Final CEPA Assessments	Manual	Chemical	CAS Number or chemical name	http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&xml=09F567A7-B1EE-1FEE-73DB-8AE6C1EB7658 http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&xml=6892C255-5597-C162-95FC-4B905320F8C9

A. Chemical verification process

1. Verify the chemical substance using chemical verification sources as noted in the *ECOTOX Chemical Verification and Entry Procedure (https://cfpub.epa.gov/ecotox/help.cfm?helptabs=tab4)*.

   Chemical verification ensures that the chemical name and CAS Number for the chemical substance linked and correct. Chemical verification sources are searched by the name and/or CAS Number and are cross-checked to ensure the chemical name - CAS Number relationship is valid. Additional information including synonyms and molecular formulas are also located in the verification sources. Once the name and CAS Number have been verified, they are entered into the U.S.EPA's ECOTOX chemical file for use. The primary source for chemical verification is STN International, http://www.stn-international.com (operated by Chemical Abstract Services) and contains information on all classes of chemicals, organic, pesticides, inerts, solvents, etc. The chemical verification sources include:

   - Online Databases, e.g. STN International (http://www.stn-international.com)
   - Chemical Compendiums, e.g. Dictionary of Organic Chemicals, Registry of Toxic Effects of Chemical Substances
   - Chemical Catalogs, e.g. Sigma-Aldrich (https://www.sigmaaldrich.com)
   - Internet websites, e.g. company websites displaying chemical MSDS and label Information

2. Find related chemicals that may be of interest to OPPT RAD (the relationship of the chemicals are noted in Table_Apx D-2, column headed Relationship, e.g. Parent, is the chemical substance requested, Degradates (chemicals formed as the chemical substance is degraded), and Related compounds (similar in structure to the chemical substance requested, e.g. isomers)), if located. Synonym names and trade names to include in the literature search strategy are also located. Sources for related chemicals and synonym chemical names are at:

   - PAN: The Pesticide Action Network (http://www.pesticideinfo.org) is a site that provides information about pesticides and also includes inerts and solvents used in chemical formulations. After entering a name or CAS number into the search field, choose the chemical of interest from the search results and scroll down to the bottom of the page. Related chemicals will be listed here along with a reason. Parent chemicals, derivatives, and degradates/metabolites can be found here.

   - PFATE: EPA's Pesticide Fate Database (located at the contractor's site) is a database that provides degradates for chemicals, mostly pesticides. Searching on a chemical name returns associated degradates.

   - DOC: Dictionary of Chemical Names and Synonyms for synonym names. STN should also be used for the synonym search if a search was conducted to verify the chemical.

   - ECOTOX: Search the U.S. EPA's ECOTOX chemical database for chemical synonyms and related chemicals. (www.epa.gov/ecotox)

- Additional chemical verification sources, if needed from Appendix A from the *ECOTOX Chemical Verification and Entry Procedure (https://cfpub.epa.gov/ecotox/help.cfm?helptabs=tab4)* contains a list of approved sources of verification for chemical names and structures. Common sources searched may include:

  - Registry of Toxic Effects of Chemical Substances
  - TSCA Chemical Substances Inventory
  - Compendium of Pesticide Common Names
  - California Department of Pesticide Regulation

- If the chemical cannot be found on these websites or any other approved sources, an Internet search is performed to locate additional information.

B. UNIFY Chemical Report Setup Worksheet

Step 1. Identifying the chemical name(s), CAS number(s) and related chemicals. If related chemicals are located, add a line Table_Apx D-2.

Chemical requested: Cyclic Aliphatic Bromides Cluster

STN International (STN) - http://www.stn-international.com

CAS # 25637-99-4

Cyclododecane, hexabromo-
Hexabromocyclododecane
BRE 5300
Bromkal 73-6CD
CD 75
CD 75P
FR 1010
FR 104
FR 104 (fireproofing agent)
FR 1206ILM
FR-CD
HBCD
HBCD-LM
HBCD-LMS
HBCD-SP 75
HP 900
HP 900G
Myflam 11645
Nicca Fi-None CG 1
Nicca Fi-None TS 1
Nicca Fi-None TS 3
Nicca Fi-None TS 88

Pyroguard F 800
Pyroguard SR 103
Pyroguard SR 103A
Pyroguard SR 103HR
Pyrovatex 3887
Safron 5261
Saytex HBCD
Saytex HBCD-LM
Saytex HBCD-SF
Saytex HP 900
Saytex HP 900G
SP 75
SR 103
YM 88

Pesticide Action Network (PAN) - http://www.pesticideinfo.org/
Hexabromocyclododecane – 25637-99-4 (Parent compound)
Chemical Uses: PAN – not listed

25637-99-4 (CAS number) , 25637994 (CAS number without hyphens) , Hexabromocyclododecane

PFATE
No additional or related chemical information located.

ECOTOX Chemical database
Contains "Hexabromocyclododecane"

No additional or related chemical information located.

Online - https://www.epa.gov/sites/production/files/2015-09/documents/hbcd_problem_formulation.pdf

Related Chemical: 1,2,5,6,9,10-Hexabromocyclododecane, CAS# 3194-55-6
Related Chemical: 1,2,5,6-Tetrabromocyclooctane, CAS# 3194-57-8
Related Chemical: alpha-Hexabromocyclododecane, CAS# 134237-50-6
Related Chemical: beta-Hexabromocyclododecane, CAS# 134237-51-7
Related Chemical: gamma-Hexabromocyclododecane, CAS# 134237-52-8
Related Chemical: 1,2,3,4,5,6-Hexabromocyclohexane, CAS# 1837918
Related Chemical: 1,2,3,4,5-Pentabromo-6-chlorocyclohexane, CAS# 87843
Related Chemical: Tetrabromocyclododecane, CAS# 30178928
Related Chemical: 1,5,9-Cyclododecatriene (Unable to verify)
Related Chemical: (E,Z,Z)-Cyclododeca-1,5,9-triene (Unable to verify)
Related Chemical: Polybromocycloalkane (Unable to verify)
Related Chemical: Dibromocyclododecadiene (Unable to verify)

Table_Apx D-2. Chemical(s) located for Cyclic Aliphatic Bromine Cluster (HBCD)
*Related compounds were to be included in the search per EPA.

Chemical Name	CAS #	Relationship (e.g., Parent, Degradate) and Source
Hexabromocyclododecane	25637994	Parent (PAN)
1,2,5,6,9,10-Hexabromocyclododecane	3194556	Related(Online)
1,2,5,6-Tetrabromocyclooctane	3194578	Related (Online)
alpha-Hexabromocyclododecane	134237506	Related (Online)
beta-Hexabromocyclododecane	134237517	Related (Online)
gamma-Hexabromocyclododecane	134237528	Related (Online)
1,2,3,4,5,6-Hexabromocyclohexane	1837918	Related (Online)
1,2,3,4,5-Pentabromo-6-chlorocyclohexane	87843	Related (Online)
Tetrabromocyclododecane	30178928	Related (Online)
1,5,9-Cyclododecatriene	Unable to verify	Related (Online
(E,Z,Z)-Cyclododeca-1,5,9-triene	Unable to verify	Related (Online
Polybromocycloalkane	Unable to verify	Related (Online
Dibromocyclododecadiene	Unable to verify	Related (Online

RELATED CHEMICALS (If related chemicals are located, add a line to the table above.)
Related chemicals added to the table.

Step 2. Create a unique list of Chemical Search Terms

From the searches conducted in Step 1, chemical terms from searches are listed below, create a unique list of chemical terms to be used for the Chemical of Concern literature search. Non-English, long scientific chemical names and terms documented to cause false hits are not used and are not in bold. Note that if one term is part of another term, e.g. Tetrachloromethane and 1,1,1,1-Tetrachloromethane, only the first term is used, e.g. Tetrachloromethane. Terms used to generate the final list of chemical terms are in **BOLD.**

1. STN

Cyclododecane, hexabromo-
Hexabromocyclododecane
BRE 5300
Bromkal 73-6CD
CD 75
CD 75P

FR 1010
FR 104
FR 104 (fireproofing agent)
FR 1206ILM
FR-CD
HBCD
HBCD-LM
HBCD-LMS
HBCD-SP 75
HP 900
HP 900G
Myflam 11645
Nicca Fi-None CG 1
Nicca Fi-None TS 1
Nicca Fi-None TS 3
Nicca Fi-None TS 88
Pyroguard F 800
Pyroguard SR 103
Pyroguard SR 103A
Pyroguard SR 103HR
Pyrovatex 3887
Safron 5261
Saytex HBCD
Saytex HBCD-LM
Saytex HBCD-SF
Saytex HP 900
Saytex HP 900G
SP 75
SR 103
YM 88

Related Chemicals from STN (to be included in the search per EPA)

3194-55-6
Cyclododecane, 1,2,5,6,9,10-hexabromo-
1,2,5,6,9,10-Hexabromocyclododecane
Bromkal 73-6D
FR 1206
FR 1206HT
Pyroguard SR 104
SR 104
YM 88A

3194-57-8
Cyclooctane, 1,2,5,6-tetrabromo-
1,2,5,6-Tetrabromocyclooctane
NSC 167079

134237-50-6
(±)-alpha-HBCD

(±)-alpha-Hexabromocyclododecane
alpha-HBCD
alpha-Hexabromocyclododecane

134237-51-7
(±)-beta-HBCD
(±)-beta-Hexabromocyclododecane
beta-HBCD
betaa-Hexabromocyclododecane

134237-52-8
(±)-gamma-HBCD
(±)-gamma-Hexabromocyclododecane
gamma-HBCD
gamma-Hexabromocyclododecane

1837-91-8
Cyclohexane, 1,2,3,4,5,6-hexabromo-
1,2,3,4,5,6-Hexabromocyclohexane
Benzene hexabromide
NSC 7908

87-84-3
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-
1**,2,3,4,5-Pentabromo-6-chlorocyclohexane**
Chloropentabromocyclohexane
FR 651A
FR 651P
Pentabromochlorocyclohexane

30179-92-8
Cyclododecane, tetrabromo-
Tetrabromocyclododecane

Chemicals unable to be verified
1,5,9-Cyclododecatriene
(E,Z,Z)-Cyclododeca-1,5,9-triene
Polybromocycloalkane
Dibromocyclododecadiene

2. PAN

25637-99-4 (CAS number) , 25637994 (CAS number without hyphens) , Hexabromocyclododecane

Final chemical terms to use for the Chemical of Concern Literature search derived from the chemical lists above.

CAS Number(s):

25637-99-4, 3194-55-6, 3194-57-8, 134237-50-6, 134237-51-7, 134237-52-8

Chemical Names:

1,2,5,6,9,10-Hexabromocyclododecane
1,2,5,6-Tetrabromocyclooctane
BRE 5300
Bromkal 73-6CD
Bromkal 73-6D
CD75
CD75P
FR 1010
FR 104
FR 1206
FR 1206HT
FR 1206ILM
FR-CD
Hexabromocyclododecane
HP 900
HP 900G
Myflam 11645
Nicca Fi-None CG 1
Nicca Fi-None TS 1
Nicca Fi-None TS 3
Nicca Fi-None TS 88
NSC 167079
Pyroguard F 800
Pyroguard SR 103
Pyroguard SR 103A
Pyroguard SR 103HR
Pyroguard SR 104
Pyrovatex 3887
Safron 5261
Saytex HBCD
Saytex HBCD-LM
Saytex HBCD-SF
Saytex HP 900
Saytex HP 900G
SP 75
SR 103
SR 104
YM 88
YM 88A
1,2,3,4,5,6-Hexabromocyclohexane
Benzene hexabromide
NSC 7908
1,2,3,4,5-Pentabromo-6-chlorocyclohexane
Chloropentabromocyclohexane
FR 651A

FR 651P
Pentabromochlorocyclohexane
Tetrabromocyclododecane
1,5,9-Cyclododecatriene
(E,Z,Z)-Cyclododeca-1,5,9-triene
Polybromocycloalkane
Dibromocyclododecadiene

GENERAL: *These are the search terms compiled from the Chemical Report for Cyclic Aliphatic Bromides Cluster to be used in the search strategies for each of the databases listed below.*

(E,Z,Z)-Cyclododeca-1,5,9-triene OR 1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane OR 1,2,3,4,5,6-Hexabromocyclohexane OR 1,2,3,4,5-Pentabromo-6-chlorocyclohexane OR 1,2,5,6,9,10-Hexabromocyclododecane OR 1,2,5,6-Tetrabromocyclooctane OR 1,5,9-Cyclododecatriene OR 4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane OR Benzene hexabromide OR BRE 5300 OR Bromkal 73-6CD OR Bromkal 73-6D OR CD75 OR CD75P OR Chloropentabromocyclohexane OR Citex BCL 462 OR Dibromocyclododecadiene OR FR 1010 OR FR 104 OR FR 1206 OR FR 1206HT OR FR 1206ILM OR FR 651A OR FR 651P OR FR-CD OR Hexabromocyclododecane OR HP 900 OR HP 900G OR Myflam 11645 OR Nicca Fi-None CG 1 OR Nicca Fi-None TS 1 OR Nicca Fi-None TS 3 OR Nicca Fi-None TS 88 OR NSC 167079 OR NSC 7908 OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR Pyroguard F 800 OR Pyroguard SR 103 OR Pyroguard SR 103A OR Pyroguard SR 103HR OR Pyroguard SR 104 OR Pyrovatex 3887 OR Safron 5261 OR Saytex BCL 462 OR Saytex HBCD OR Saytex HBCD-LM OR Saytex HBCD-SF OR Saytex HP 900 OR Saytex HP 900G OR SP 75 OR SR 103 OR SR 104 OR Tetrabromocyclododecane OR YM 88 OR YM 88A
Based upon the online search manuals for the respective databases below, it was necessary to construct searches as follows:

SCIENCE DIRECT: (www.sciencedirect.com) *General Search Terms applied to the search strategy for Science Direct*
Date Searched: 01/13/2017
Date Range of Search: 1823 to Present
N=339

Tak("(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD" OR "Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3" OR "Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR

"Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G" OR "SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A") AND NOT key(human* or child* or occupat* OR infant* OR homind* OR woman OR women OR patient* OR OSHA OR chromatograph* OR Spectrometr* OR pediatric*)

AGRICOLA: (www.nal.usda.gov) *General Search Terms applied to the search strategy for Agricola. The Agricola database contains a significant amount of gray literature including proceedings, symposia, and progress reports from government and educational institutions. This database categorizes literature as an "article" or a "book."*
Date Searched: 01/13/2017
Date Range of Search: 15th Century to Present
N=595

Agricola limits the search to 383 characters and therefore it is searched in sections to cover all of the compiled General Terms.

Articles:
"(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD"

"Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3"

"Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR "Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G"

"SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A"

Books: *Agricola limits the amount of search terms to be entered and searched in sections to cover all of the compiled General Terms.*
"(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD"

Search resulted in no hits.

"Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3"

"Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR "Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G"

Search resulted in no hits.

"SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A"

TOXNET: (toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?TOXLINE) *General Search Terms applied to the search strategy for TOXNET.*
Date Searched: 01/13/2017
Date Range of Search: 1900 to Present
N=604

25637-99-4 OR 3194-55-6 OR 3194-57-8 OR 134237-50-6 OR 134237-51-7 OR 134237-52-8 OR 25637-99-4 OR 3194-55-6 OR 3194-57-8 OR 25637-99-4 OR 3194-55-6 OR 3194-57-8
PROQUEST CSA: (www.csa.com) *General Search Terms applied to the search strategy for ProQuest CSA.*
Date Searched: 01/13/2017
Date Range of Search: 1900 to Present
N=177

ALL("(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD" OR "Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3" OR "Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR "Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G" OR "SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A") AND STYPE("Scholarly Journals" OR Reports OR Thesis OR "Government Documents") AND(su(toxicity OR toxicology OR bioassay* or lethal OR bioaccum*) OR cc(01504 or 08504 or “D 047*” or “X 241*”) OR (LC NEAR/3 50)) NOT IF(m?n or human* or child* or occupant* or infant* or wom?n or patient* or pediatric) AND LA(ENG)

PROQUEST DISSABS: (search.proquest.com) *General Search Terms applied to the search strategy for ProQuest DISSABS.*
Date Searched: 01/13/2017
Date Range of Search: 1900 to Present
N=71

ALL("(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD" OR "Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3" OR "Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR "Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G" OR "SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A") NOT IF(m?n or human* or child* or occupant* or infant* or wom?n or patient* or pediatric) AND LA(ENG)

CURRENT CONTENTS: (https://access.webofknowledge.com/) *General Search Terms applied to the search strategy for Current Contents.*
Date Searched: 01/13/2017
Date Range of Search: 1970 to Present
N=595

TS=("(E,Z,Z)-Cyclododeca-1,5,9-triene" OR "1-(1,2-Dibromoethyl)-3,4-dibromocyclohexane" OR "1,2,3,4,5,6-Hexabromocyclohexane" OR "1,2,3,4,5-Pentabromo-6-chlorocyclohexane" OR "1,2,5,6,9,10-Hexabromocyclododecane" OR "1,2,5,6-Tetrabromocyclooctane" OR "1,5,9-Cyclododecatriene" OR "4-(1,2-Dibromoethyl)-1,2-dibromocyclohexane" OR "Benzene hexabromide" OR "BRE 5300" OR "Bromkal 73-6CD" OR "Bromkal 73-6D" OR "CD75" OR "CD75P" OR Chloropentabromocyclohexane OR "Citex BCL 462" OR Dibromocyclododecadiene OR "FR 1010" OR "FR 104" OR "FR 1206" OR "FR 1206HT" OR "FR 1206ILM" OR "FR 651A" OR "FR 651P" OR "FR-CD" OR Hexabromocyclododecane OR "HP 900" OR "HP 900G" OR "Myflam 11645" OR "Nicca Fi-None CG 1" OR "Nicca Fi-None TS 1" OR "Nicca Fi-None TS 3" OR "Nicca Fi-None TS 88" OR "NSC 167079" OR "NSC 7908" OR Pentabromochlorocyclohexane OR Polybromocycloalkane OR "Pyroguard F 800" OR "Pyroguard SR 103" OR "Pyroguard SR 103A" OR "Pyroguard SR 103HR" OR "Pyroguard SR 104" OR "Pyrovatex 3887" OR "Safron 5261" OR "Saytex BCL 462" OR "Saytex HBCD" OR "Saytex HBCD-LM" OR "Saytex HBCD-SF" OR "Saytex HP 900" OR "Saytex HP 900G" OR "SP 75" OR "SR 103" OR "SR 104" OR Tetrabromocyclododecane OR "YM 88" OR "YM 88A")

ECOTOX (production.ecodev.csgov.com/unify/) *Results from the ECOTOX search strategy. These results are derived from the publications that are available in the ECOTOX database. This website is not accessible to the public.*
Date Searched: 01/13/2017
Date Range of Search: 01/01/1900 to 01/13/2017
N=70

The two sources listed below are used if very few articles are identified in the searches above. The two sources listed below have very high non-applicability rates and not cost effective in most cases.

SCIFINDER: (www.cas.org/)

SciFinder search was not run.

PUB MED: (www.ncbi.nlm.nih.gov/PubMed/)

PubMed search was not run.

E. DEVELOPMENT OF TAGS WITH INCLUSION/EXCLUSION CRITERIA

E-1 Inclusion/Exclusion Criteria and Tags for the Fate Literature

Table_Apx E-1. Tags and Inclusion/Exclusion Criteria for Cyclic Aliphatic Bromine Cluster (HBCD) for the Fate Topic Area

Tag	Inclusion/Exclusion Criteria	Example Keywords
ON TOPIC, GENERAL FATE TAGS		
Fate and Transport Data	**INCLUDE:** • Studies providing pchem property data that describe/impact fate and transport **EXCLUDE:** • Laboratory experiments using laboratory-derived chemicals or laboratory simulations, not using environmental samples, unless rate constant or coefficient is derived; • Laboratory experiments using environmental sample under non-natural conditions or added substrates, not naturally occurring in environment	K_{OA}, K_{OW}, K_{AW}, K_{OC}, K_d, partitioning coefficient, fugacity, flux, groundwater, migration, sediment, leach, soil, sorb, sorption, adsorption, dust, particles, aerosol, volatility, solubility
Environmental Persistence	**INCLUDE:**	Persistence, half-life, hydrolysis, photolysis, photostability, biodegradation, aerobic, anaerobic, metabolism, reduction, degradation, transformation

	• Studies that indicate persistence, transformation, and degradation in the environment	
Bioaccumulation	**INCLUDE:** • studies pertaining to bioaccumulation, bioconcentration, and trophic magnification **EXCLUDE:** • Studies where chemical is given to animal in lab setting where conditions where conditions are clearly not relevant to naturally-occurring conditions • Studies in humans, these can fall under Human Health, ADME	BCF, BAF, BSAF, trophic magnification, biomagnification, bioaccumulation, bioconcentration, biota sediment accumulation factor, biotransfer
Wastewater Removal	**INCLUDE:** • sewage or wastewater treatment, treatment facilities, and effluent **EXCLUDE:** • test systems, laboratory experiments, or demonstrations where conditions are clearly not relevant to naturally-occurring conditions	Sewage or wastewater treatment, WWTP, POTW, sludge, effluent
Other supporting fate and transport	**INCLUDE:** • studies supporting or possibly supporting fate and transport, but not a study that can be included in one or more of the preceding relevant categories	
ON TOPIC, GENERAL STUDY TAGS		
Data Type	**INCLUDE:** Empirical Modeled	Empirical: measured Modeled: simulated, estimated, modeled
Source Type	**INCLUDE:** Database Search Gray Literature ○ EPA Source ○ Other Government Source ○ Industry-Specific Source ○ Peer-reviewed Literature ○ Direct Communications Primary Source	Determination of source type of database search or gray literature is by search type, rather than keyword. Primary Source: Novel, experimental, modeling Secondary Source: Review

	Secondary Source	
Use Specific	**INCLUDE:** Source contains use-specific data or information	polystyrene, foam, textiles, automotive
Chemical Specific	**INCLUDE:** Source contains information specific to the chemical of interest	HBCD and synonyms
Regulatory	**INCLUDE:** Source contains a regulatory value/limit	Water quality criteria, NAAQS[2], IRIS[2]
OFF TOPIC		
Off Topic	**INCLUDE:** Off topic in context of identified information needs	
OTHER		
Not peer-reviewed	**INCLUDE:** Published without formal peer review. Use in addition to relevant or not relevant (not an exclusive tag).	
Foreign language	**INCLUDE:** Full-text published in non-English language. Use in addition to relevant or not relevant (not an exclusive tag).	

[1]National Ambient Air Quality Standard
[2]Integrated Risk Information System

E-2 Inclusion/Exclusion Criteria and Tags for the Engineering/Occupational Exposure Literature

Table_Apx E-2. Tags and Inclusion/Exclusion Criteria for Cyclic Aliphatic Bromine Cluster (HBCD) for the Engineering/Occupational Exposure Topic Area

Tag	Inclusion/Exclusion Criteria	Example Keywords
ON TOPIC, GENERAL ENGINEERING TAGS		
Process Info	**INCLUDE:** • Studies pertaining to chemical processes containing information on life cycle, production volume, descriptions of processes, and manufacturing sites **EXCLUDE:** • Studies involving Superfund sites, these might fall under Exposure	Life cycle, production volume, use volume, import, process description, process flow diagram, product concentration, sites, manufacture, process
Occupational Exposure	**INCLUDE:** • Occupational exposure studies that contain or may contain information on worker activities, amount of workers exposed, routes of exposure, personal and work area monitoring data (job titles), exposure modeling, and/or interventions to reduce exposure such as PPE or engineering controls	Worker, worker activities, worker exposure, occupational exposure, inhalation, dermal, personal sample, time-weighted average, breathing zone, PPE, personal protective equipment, engineering controls, exposure reduction, ventilation
Environmental Releases	**INCLUDE:** • Studies pertaining to releases from manufacturing waste streams and end of life cycle processing	Release, emission, release rate, release frequency, point source, area source, air, water, landfill, incineration, POTW, on-site treatment, disposal, pretreatment program, recycling, air concentration
Other supporting	**INCLUDE:** • Studies supporting or possibly supporting engineering sections, but <u>not</u> a study included in one or more of the preceding relevant categories	
ON TOPIC, GENERAL STUDY TAGS		
Data Type	**INCLUDE:** Empirical Modeled	Empirical: measured Modeled: simulated, estimated, modeled
Source Type	**INCLUDE:** Database Search Gray Literature ○ EPA Source ○ Other Government Source ○ Industry-Specific Source	Determination of source type of database search or gray literature is by search type, rather than keyword. Primary Source: Novel, experimental, modeling Secondary Source: Review

	○ Peer-reviewed Literature ○ Direct Communications Primary Source Secondary Source	
Use Specific	**INCLUDE:** Source contains use-specific data or information	polystyrene, foam, textiles, automotive
Chemical Specific	**INCLUDE:** Source contains information specific to the chemical of interest	HBCD and synonyms
Regulatory	**INCLUDE:** Source contains a regulatory value/limit	Water quality criteria, NAAQS[2], IRIS[2]
OFF TOPIC		
Off topic	**INCLUDE:** Off topic in context of identified information needs	
OTHER		
Not peer-reviewed	**INCLUDE:** Published without formal peer review. Use in addition to relevant or not relevant (not an exclusive tag).	
Foreign language	**INCLUDE:** Full-text published in non-English language. Use in addition to relevant or not relevant (not an exclusive tag).	

[1]National Ambient Air Quality Standard

[2]Integrated Risk Information System.

E-3 Inclusion/Exclusion Criteria and Tags for the Exposure Literature

Table_Apx E-3. Exposure Inclusion/Exclusion Criteria Cyclic Aliphatic Bromine Cluster (HBCD) and Tags

Tag	Inclusion/Exclusion Criteria	Example Keywords
ON TOPIC, GENERAL EXPOSURE TAGS		
Ecological	**INCLUDE:** • Covers ecological exposure, including exposure to flora and fauna **EXCLUDE:** • Studies limited to describing concentrations in mineral deposits only • Pchem properties of environmental sample or chemical structure without concentration data	concentration, mammal, avian, fish, aquatic
General Population	**INCLUDE:** • Covers exposure to the general population due to ambient concentrations in environmental media/food **EXCLUDE:** • Studies involving exposures to laboratory-produced chemical or chemical mixture in a lab setting, rather than environmentally-derived samples • Studies without measured or modeled concentrations • Studies involving measured dust concentrations from consumer products, these should be tagged to Consumer Exposure	general population exposure/dose, releases, background levels, ambient/outdoor air, deposition, surface water, drinking water, ground water, soil, sediment, sludge, disposal, life cycle
Consumers	**INCLUDE:** • Covers exposure to consumers who use a product or article containing the chemical **EXCLUDE:** • Studies involving exposures to laboratory-produced chemical, rather than environmentally-derived samples	consumer product exposure/dose, indoor/residential, product, article, aerosol, dust, indoor air, hand-to-mouth, surface, shower, dermal loading

Susceptible Population	**INCLUDE:** • Covers exposure for a particular potentially exposed and susceptible subpopulation	susceptible/sensitive subpopulation, infants, children, pregnancy, senior, aged, elderly, older women, men, gender, immunocompromised, diseased population, preexisting disease, genetics, socioeconomic status, race
Highly Exposed Population	**INCLUDE:** • Covers a population exposed at a level higher than the general population	highly-exposed sub population, near-facility population, higher-than-average exposure, above background, populations near manufacturing facilities
Other Exposure	**INCLUDE:** • Mentions uses or regulatory limits but does not contain exposure values/estimates; tag also to regulatory or use-specific if applicable • Studies supporting or possibly supporting exposure sections, but not a study included in one or more of the preceding relevant categories	
ON TOPIC, GENERAL STUDY TAGS		
Data Type	**INCLUDE:** Empirical Modeled	Empirical: measured Modeled: simulated, estimated, modeled
Source Type	**INCLUDE:** Database Search Gray Literature o EPA Source o Other Government Source o Industry-Specific Source o Peer-reviewed Literature o Direct Communications Primary Source Secondary Source	Determination of source type of database search or gray literature is by search type, rather than keyword. Primary Source: Novel, experimental, modeling Secondary Source: Review
Use Specific	**INCLUDE:** Source contains use-specific data or information	polystyrene, foam, textiles, automotive
Chemical Specific	**INCLUDE:** Source contains information specific to the chemical of interest	HBCD and synonyms
Regulatory	**INCLUDE:** Source contains a regulatory value/limit	Water quality criteria, NAAQS[2], IRIS[3]
OFF TOPIC		
Off topic	**INCLUDE:** Off topic in context of identified information needs	
Human Health	**INCLUDE:**	

	Contains information that is potentially on-topic for the human health hazard topic area	
OTHER		
Not peer-reviewed	**INCLUDE:** Published without formal peer review. Use in addition to relevant or not relevant (not an exclusive tag).	
Foreign language	**INCLUDE:** Full-text published in non-English language. Use in addition to relevant or not relevant (not an exclusive tag).	

[1]Ecological search results may overlap with environmental hazard search results. EPA intends to harmonize results during the refinement phase.
[2]National Ambient Air Quality Standard
[3]Integrated Risk Information System

E-4 Inclusion/Exclusion Criteria and Tags for the Human Health Hazard Literature

Table_Apx E-4. Human Health Hazard Inclusion/Exclusion Criteria and Tags

Tag Category	Inclusion/Exclusion Criteria	Example Keywords
ON TOPIC, GENERAL HUMAN HEALTH TAGS		
Human Hazard ID	**INCLUDE:** • Studies evaluating human health effects resulting from exposure to the chemical. Includes epidemiology studies (measure an adverse outcome in an exposed population), experimental studies (e.g. individuals exposed to chemical in a controlled study) and case studies (e.g. individual case report on accidental exposure to chemical) • Acute, subchronic, and chronic exposures **Also choose applicable health effect tags in next section "Cyclic Aliphatic Bromine Cluster (HBCD) Health Effect Tags"	case-control study; cohort study; odds ratio; risk ratio; incidence; prevalence
Animal Hazard ID	**INCLUDE:** • Studies evaluating animal health effects resulting from controlled exposure to the chemical in mammals such as primates, rodents, dog, rabbit, and mink. **Also choose applicable health effect tags in next section "Cyclic Aliphatic Bromine Cluster (HBCD) Health Effect Tags" **EXCLUDE:** • Studies in birds and fish; these can be tagged to MOA and/or ADME if applicable	chronic; developmental; incidence; NOEL/LOEL; NOAEL/LOAEL; dose; response
ADME	**INCLUDE**: • Studies describing the absorption, distribution, metabolism and elimination (ADME) of the chemical. This may include *in vitro* studies	absorption, distribution, metabolism, elimination, bioavailability, tissue burden, metabolites, analytes, excretion, elimination rates, clearance, half-life, dose-duration, km, ki, vmax, lactational transfer, inhalation pharmacokinetics, toxicokinetics, PBPK, PBTK accumulation or retention in breast milk, serum, plasma, blood, urine, feces, adipose tissue
MOA	**INCLUDE:** • Studies evaluating the mode of action (MOA) of a chemical (i.e., molecular	*in vitro* models, genomics, proteomics, genotoxicity, indirect

	events occurring after exposure that may contribute to the development of adverse health effects) in animals and humans • Evaluation of specific pathways (e.g., through the use of antioxidants to determine importance of ROS in hepatic effects) • Studies in knockout mice • Assessment of hormone levels or gland function, immune system parameters	genotoxicity, changes in gene expression or mRNA levels
Susceptibility	**INCLUDE:** • Studies that specifically evaluate genetic traits or variations, subpopulations or lifestages, in relation to Cyclic Aliphatic Bromine Cluster (HBCD) exposure/effects **EXCLUDE:** • Studies using knock-out mice	influence of genetic traits, variations, genetic polymorphisms (e.g. single nucleotide polymorphisms; SNPs) on health effects relating to the chemical
ON TOPIC, CYCLIC ALIPHATIC BROMINE CLUSTER (HBCD) HEALTH EFFECT TAGS		
Hepatic non-cancer	**INCLUDE**: • Studies evaluating hepatic effects in the liver, biliary tract, gall bladder	fatty degeneration, cirrhosis, fibrosis, necrosis, hypertrophy, hyperplasia, proliferation, increased/decreased liver enzymes, bile acids, cholesterol and triglycerides in serum/blood, increased/decreased liver weight, jaundice, vacuolization
Endocrine non-cancer	**INCLUDE:** Studies evaluating endocrine hormonal effects or effects in the thyroid, parathyroid, pituitary/hypothalamus, pineal, adrenal, and pancreas **EXCLUDE:** Effects specifically on ovaries and testes; these are categorized in the Reproductive/Developmental non-cancer tag	thyroid weight increases, changes in thyroid hormone levels such as T4 and TSH, thyroid hyperplasia).
Neurological non-cancer	**INCLUDE:** • Studies evaluating effects in the central nervous system (CNS) or peripheral nervous system (PNS), brain, nerves, behavior, neurochemical alterations, sensory effects, neurodevelopmental effects in exposed infants and children	changes in brain pathology, CNS depression (dizziness, drowsiness, sleepiness, loss of consciousness/ anesthesia, hypo activity, ataxia, lethargy, impaired coordination or balance, narcosis), nerve/neuronal injury and/or degeneration, neuropsychological outcomes (e.g. mood/personality changes), changes in neurobehavioral tests (cognitive, motor function) and neurophysiological effects (visual and auditory function), memory

Reproductive/Developmental non-cancer	**INCLUDE:** • Studies examining reproductive outcomes, offspring and/or studies examining developmental effects **Notes:** • Developmental neurotoxicity effects are categorized in the Reproductive/Developmental non-cancer tag and Neurological non-cancer tag • Developmental effects on the endocrine system are tagged as Reproductive/Developmental non-cancer and Endocrine non-cancer	reduced fertility, effects on reproductive organs, sperm, estrous cycle, increased resorption and post implantation loss, viability, fetal death, birth weight, growth, maturation, teratogenicity, birth defects, visceral and/or skeletal malformations, follicle counts
Immunological non-cancer	**INCLUDE**: • Studies examining susceptibility or resistance to infection or disease, function of innate or adaptive immunity	hypersensitization, increased/decreased white blood cells, effects on the spleen
Other health effect	**INCLUDE:** • Studies in which any other non-cancer or cancer health effects, not defined by the categories above, were examined	NA
ON TOPIC, GENERAL STUDY TAGS		

Source Type	**INCLUDE:**
	• Database Search
	• Gray Literature
	  ○ EPA Source
	  ○ Other Government Source
	  ○ Industry-Specific Source
	  ○ Peer-reviewed Literature
	  ○ Direct Communications
	• Primary Source
	• Secondary Source
		Determination of source type of database search or gray literature is by search type, rather than keyword
		
		Primary Source: Novel, experimental, modeling
		
		Secondary Source: Review

NOT ON TOPIC		
Not on topic	**INCLUDE:** • Reference is not on topic in the context of any of the outlined categories (or tags)	NA
Exposure[1]	**INCLUDE:** • Reference contains exposure information only, i.e., without associated information on health effects (e.g. clinical signs or symptoms in exposed population) and will be evaluated by that team. **Notes:** • Levels of the chemical in biological tissues or fluids were considered related to the human health discipline and categorized under the ADME tag	industrial hygiene surveys, general populations exposures (e.g. measured in air, water and food)
OTHER		

Foreign language study	**INCLUDE:** • Full-text reference published in non-English language. Use in addition to "on topic" or "off topic" tags.	Title will likely be in brackets or journal title will be in foreign language only

[1]An exposure tag was included to capture references potentially relevant to the exposure topic area to be reviewed by exposure experts

E-5 Inclusion/Exclusion Criteria for the Environmental Hazard Literature

The following are the inclusion criteria used for the results of the ECOTOX literature search. Studies that meet the acceptability criteria are considered on-topic (or applicable).

1. The paper reports toxicology information for the chemical of interest.
2. The article is published in the English language.
3. The study is presented as a full article.
4. The paper is a publicly available document.
5. The paper is the primary source of the data.
6. The paper reports a calculated endpoint.
7. The paper reports that treatment(s) were compared to an acceptable control.
8. The paper reports an explicit duration of exposure.
9. The paper reports a concurrent environmental chemical concentration/dose or application rate.
10. The paper reports the location of the study (e.g., laboratory vs. field).
11. The paper reports a biological effect.
12. The paper reports the species that was tested; and this species can be verified in a reliable source.
13. The paper reports effects associated with a single chemical exposure.

For more information, refer to the document "*ECOTOX Literature Searches, Citation Identification and Skimming*" (https://cfpub.epa.gov/ecotox/blackbox/help/ECOTOXLiteratureSearchesCitationIdentificationandSkimming.pdf).

The following is a list of ECOTOX rejection codes, exclusion terms and definitions utilized under the ECOTOX database efforts. Each citation that is identified as off topic (or not applicable) to the ECOTOX database will have one or more of these codes.

For more information, refer to the document *ECOTOX Literature Searches, Citation, Identification and Skimming* (https://cfpub.epa.gov/ecotox/blackbox/help/ECOTOXLiteratureSearchesCitationIdentificationandSkimming.pdf) under Appendix C: Unify References Data Fields and Codes.

Table_Apx E-5. ECOTOX Codes Denoting Exclusion Criteria

Keyword	Description
ABSTRACT	Study results published as an abstract only.
ADDENDUM	Publication is a supplement to another publication and attach to that full publication (erratum or addendum).

BACTERIA	Bacteria and microbes - for microbes, enter bacteria as keyword, Includes microbes and Microtox tests.
BENEFICIAL EFFECT	Studies that result in a positive effects (improving the health of the organism
BIOLOGICAL TOXICANT	General biological toxicants including venoms, fungal toxins, Bacillus thuringiensis, and other plant, animal or microbial extracts or toxins not purified.
CAS # UNAVAILABLE	Chemical is not verifiable or no CAS # available.
CHEM METHODS	The description of chemical analysis procedures and measurements in a laboratory setting. No organism or biochemical measurements are reported in the paper.
ECOCHEM VERIFICATION SOURCE	Publication used to verify chemical CAS or physical/chemical properties.
EFFLUENT	Includes sewage and polluted runoff. Used in aquatic publications. Terrestrial categorized under MIXTURE keyword.
FATE	Chemical distribution in natural media (water, soil, air) and residue not measured in the organism or valid ECOTOX organism not present.
FOOD	Test organism is dead or harvested in the form of consumer-ready food products. Frequently studies include analyses of fresh meat or produce purchased in a market, or processed and packaged foods (e.g., wine, cheese, canned fish, sausages, packaged milk, or cereal products). This includes market studies used to enhance the marketability of an organism and maximize a producer's profit. Optimum marbling of meat, color of apple skins, and firmness of bananas for durability in shipping.
HUMAN HEALTH	Studies with human subjects or with surrogate animal subjects for human health risk assessment. If a surrogate laboratory rodent (RODE) or domestic animal (DOM,DOMA) is tested, citations will be rejected unless the effect is GRO, MOR, POP, BEH (feeding/reproductive behavior only) or REP.
INCIDENT	Reports of animal deaths by poison, which lacks a usable concentration and/or duration.
INCOMPLETE CITATION	Citation is not complete; order status ARCHIVE.
INCORRECT CITATION	Citation is wrong; order status ARCHIVE.
INHALE	Inhalation dose route only. Keyword also used for intratracheal instillation of a chemical directly into the lungs.
METHODS	Publication provides documentation for toxicology test methods, experimental design, statistical methods, standard terminology, recently developed test methods.
MIXTURE	No single chemical tests reported. The exception for In Situ studies (field studies of chemicals mixtures) are coded for bioaccumulation, if the exposure duration and concentrations of any specific chemical component of the ambient water or effluent is given for caged or transplanted organisms.
MODELING	Modeling only, no new organism exposure data; modeling studies may report original toxicity tests performed as comparisons or as a basis for extrapolation, if so, papers are ordered.
NO CONC	No usable dose or concentration reported after examination of the entire paper; includes lead shot studies lacking dose information and which report only the number of pellets. Concentrations reported in log units only are not coded.
NO DURATION	No duration reported (entire publication examined).
NO EFFECT	No organism effect reported. Chemical metabolism is included (defined as biological effect on the chemical).
NO SOURCE	Source of publication undetermined; order status ARCHIVE (includes internal chemical company document and personal communication citations).
NO TOXICANT	No chemical toxicant added or not ecotoxicologically relevant chemical. - includes ambient air component chemicals (ozone, CO2, SO2) and pollution -other ambient conditions including changes in conditions (other than chemical addition), including radioactivity, ultraviolet light (UV), temperature, pH, salinity, dissolved oxygen (DO), or other water, air or soil parameters
NON-ENGLISH	Paper's full text language other than English - (these papers do not receive ECOREF numbers).
NUTRIENT	*In situ* chemicals tested as nutrients.

OIL	Oil and petroleum products
PUBL AS	Paper (by same author/study) was published in another journal or book, ECOREF number of other paper listed in References citation. Ex. Publ As #####
QSAR	Quantitative Structure Activity Relationships.
REFS CHECKED	References in a REVIEW have been checked.
RETRACTED	Retracted article from publication by journal.
REVIEW	All toxicity tests reported elsewhere; REVIEW bibliography may be skimmed to identify relevant citations.
SEDIMENT CONC	Chemical concentration reported in sediment only (if pore or overlying water concentrations reported, then applicable).
SKIMMED	Used to show that publication has been skimmed for applicable sections.
SPECIES VERIFICATION SOURCE	Publication used to verify species common or scientific name.
SURVEY	Measured chemical present in organism, but lacking quantification of exposure; lacks usable concentration and/or duration.
VIRUS	Virus used as a test organism.
YEAST	Yeast used as test organism.