National Toxicology Program
U.S. Department of Health and Human Services

PROTOCOL FOR SYSTEMATIC REVIEW OF

BISPHENOL A (BPA) ANALOGUES

August 2015

Office of Health Assessment and Translation
Division of the National Toxicology Program
National Institute of Environmental Health Sciences

TABLE OF CONTENTS

BACKGROUND AND SIGNIFICANCE

Background

Bisphenol A (BPA) is a high production volume chemical used in the manufacture of polycarbonate plastics, epoxy resins, as a dye developer in thermal paper, and as a polymerization inhibitor in the formation of some polyvinyl chloride plastics (NTP 2008, FAO/WHO 2011, EFSA 2013). Polycarbonates are in consumer products such as plastic dinnerware, microwave ovenware, eyeglass lenses, toys, pacifiers, impact-resistant safety equipment, compact discs and automobile parts. Epoxy resins are used in protective linings of canned food and beverage containers, drinking water storage tanks, wine vat linings, some paints, floorings, and some dental composites (NTP 2008, FAO/WHO 2011, EFSA 2013). The types of thermal paper products where BPA might be used as a developer include cash register receipts and certain medical technical paper (Östberg and Noaksson 2010, EFSA 2013). Consequently, human exposure is widespread. BPA has been detected in the urine of 92% of Americans surveyed in the 2003-2004 National Health and Nutrition Examination Survey (NHANES) (Calafat *et al.* 2008). BPA has been reported to cause a wide range of adverse health outcomes in experimental animal studies; some similar findings in humans have also been linked to BPA exposure in observational epidemiology studies (vom Saal *et al.* 2007, National Toxicology Program (NTP) 2008, FAO/WHO 2011, Rochester 2013).

Recent studies report widespread exposure to a variety of chemicals with structural or functional similarity to BPA, often referred to as BPA analogues or derivatives (and hencefore referred to generically as BPA analogues) (**Table 1**). BPA analogues have been detected in foodstuff (Cacho *et al.* 2012, Liao and Kannan 2013), house dust (Liao *et al.* 2012b), river and lake sediment (Liao *et al.* 2012e), personal care products (Liao and Kannan 2014), and thermal paper (Liao *et al.* 2012d, Becerra and Odermatt 2013). Several chlorinated and brominated derivatives of BPA are used as flame-retardants (Voordeckers *et al.* 2002, NTP 2008, FAO/WHO 2011, EFSA 2013). Importantly, BPA analogues have also been detected in human biological specimens (e.g. blood and urine) (Cobellis *et al.* 2009, Cobellis *et al.* 2010, Cunha and Fernandes 2010, Liao *et al.* 2012a, Zhou *et al.* 2013, Zhou *et al.* 2014). Other chemicals have also been identified as theoretical alternatives to BPA in thermal paper, although the extent to which they are actually being used is not known (U.S EPA 2014).

Rationale for Review

In contrast to BPA, most BPA analogues are poorly understood with respect to potential toxicity (NTP 2013, US EPA 2014). Use of these compounds may increase, however, as companies move towards using alternatives to BPA in consumer products (FDA 2012, FDA 2013, FIOH 2014). Two BPA analogues, BPS and BPF have been recently reviewed (Rochester and Bolden 2015). However, the toxicology data for the other BPA analogues has only been summarized in government reports (NTP 2013, US EPA 2014) and a comprehensive review of these BPA analogues has not been published.

Significance

The NTP evaluation will focus on 24 BPA analogues (**Table 1**) that were prioritized for inclusion in this systematic review based on (1) detection in the environment (e.g., dust, water, sewage), foodstuff, or human biological samples; (2) identification by the U.S. EPA Design for the Environment (DfE) program as being a potential alternative to BPA in thermal paper (US EPA 2014); (3) use as a halogenated flame retardant; and (4) considered of emerging interest, i.e. relatively data-poor and not the focus of previous or ongoing hazard or risk evaluations. Given that the data on any particular chemical is expected to be small and primarily limited to *in vitro* analyses (NTP 2013, US EPA 2014) the NTP

evaluation is not expected to reach NTP hazard conclusions. Rather, the evaluation will be presented as a "state-of-the-science" evaluation that will highlight areas of understanding as well as areas where more evidence is needed. This document will be very useful for organizations pursuing assessment of structural and/or functional alternatives to BPA. Data management will be conducted in a manner that permits public sharing of the literature search results as well as the sharing of data extracted from included studies in a database format when the report is finalized following peer-review.

Table 1. Twenty Four BPA Analogues for Systematic Review

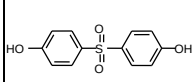
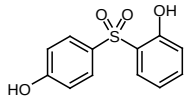
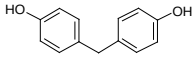
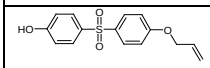
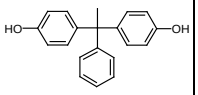
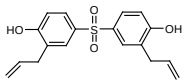
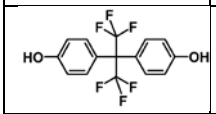
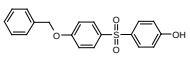
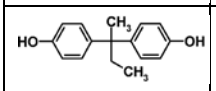
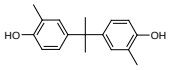
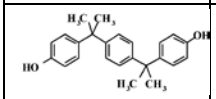
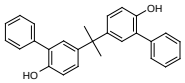
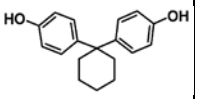
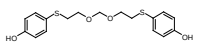
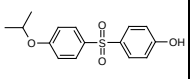
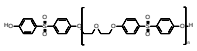
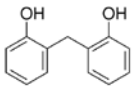
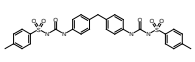
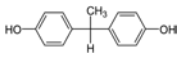
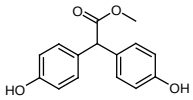
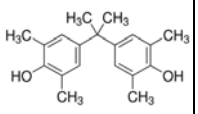
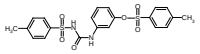
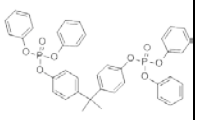
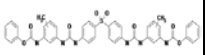
Structure	Chemical (CASRN)*	Abbreviation	Structure	Chemical (CASRN)*	Abbreviation
	Bisphenol S (80-09-1)	BPS		2,4-Bisphenol S (5397-34-2)	2,4-BPS
	Bisphenol F (620-92-8)	4,4-BPF		Bisphenol S-MAE (97042-18-7)	BPS-MAE
	Bisphenol AP (1571-75-1)	BPAP		Bis(3-allyl-4-hydroxyphenyl) sulfone (41481-66-7)	TGSA
	Bisphenol AF (1478-61-1)	BPAF		Bisphenol S-MPE (63134-33-8)	BPS-MPE
	Bisphenol B (77-40-7)	BPB		Bisphenol C (79-97-0)	BPC
	Bisphenol P (2167-51-3)	BPP		BisOPP-A (24038-68-4)	BPPH
	Bisphenol Z (843-55-0)	BPZ		1,7-bis(4-Hydroxyphenylthio)-3,5-dioxaheptane (93589-69-6)	DD-70
	4-Hydroxyphenyl 4-isoprooxy phenylsulfone (95235-30-6)	D-8		Phenol, 4,4'-sulfonylbis-, polymer with 1,1'-oxybis[2-chloroethane] (191680-83-8)	D-90
	Bisphenol F (2467-02-9)	2,2-BPF		4,4'-bis(N-carbamoyl-4-methylbenzene sulfomide) diphenylmethane (151882-81-4)	BTUM

Table 1. Twenty Four BPA Analogues for Systematic Review					
Structure	**Chemical (CASRN)***	**Abbreviation**	**Structure**	**Chemical (CASRN)***	**Abbreviation**
	Bisphenol E (2081-08-5)	BPE		Methyl bis(4-hydroxyphenyl) acetate (5129-00-0)	MBHA
	Tetramethyl Bisphenol A (5613-46-7)	TMBPA		Pergafast 201 (232938-43-1)	Pergafast 201
	Bisphenol A bis(diphenyl phosphate) (5945-33-5)	BDP		Urea urethane compound (321860-75-7)	UU
*CASRN is the Chemical Abstract Services Registry Number and is a unique identifier assigned by Chemical Abstract Services to every chemical substance.					

OVERALL OBJECTIVE AND SPECIFIC AIMS

Objective

The overall objective of this review is to answer the question: "What is the biological activity of the BPA analogues of emerging public health concern?"

Specific Aims

- Identify all of the human, animal, and *in vitro* literature concerning health outcome or biological response of BPA analogues with the most potential for human exposure;
- Extract data from the identified relevant studies;
- Assess the risk of bias of individual animal and human studies;
- Synthesize and summarize the existing evidence based on associated health outcome or biological response using a narrative approach;
- Evaluate the structural and biological similarity of the analogues to each other, to BPA, and to potent estrogens E2 and/or EE2 within the National Toxicology Program's (NTP) Tox21 and U.S. Environmental Protection Agency's (US EPA) ToxCast high throughput screening (HTS) platforms;
- Conduct network analysis to identify chemicals most biologically similar to the BPA analogues in Tox21, and;
- Identify data gaps where additional research should be pursued that could aid in assessment of BPA alternatives.

To address our overall objective we developed a PECO statement (participants, exposure, comparator, and outcomes) (**Table 2**) to aid in developing the evaluation question, the search terms, and the inclusion/exclusion criteria for our review (Higgins and Green 2011, AHRQ 2014). The PECO statement was developed based on a series of problem formulation steps that included (1) assembling an

NIEHS/NTP evaluation design team with expertise in bisphenol A and alternatives, toxicology/epidemiology, systematic review, information science, and analysis of high throughput screening data; and (2) consultation with scientists at state government and other Federal agencies. More details about problem formulation activities can be found in the evaluation protocol (see "Step 1. Problem Formulation" below).

Table 2. PECO (participants, exposure, comparator, and outcomes) statement

PECO Element	Evidence
Population	Human, animal (whole organism), or ex vivo/in vitro models utilizing organs, tissues, cell lines, or cellular components (e.g. cell free receptor binding assays).
Exposure	Exposure to at least 1 of the 24 BPA analogues listed in **Table 1**.
Comparators	Humans, animals, organs, tissues, cell lines, or cellular components exposed to a lower level of a BPA analogue than the more highly exposed subjects or treatment groups, or vehicle-only treatment.
Outcomes	No restriction on health outcome or type of biological response.

Key Questions and Analytical Framework

The overall objective of the evaluation is represented in an analytical framework, which is a schematic that illustrates the key questions (KQ) or contextual topics (CT) to be considered and types of evidence to be included in the evaluation (**Figure 1**).

Figure 1. Analytical Framework

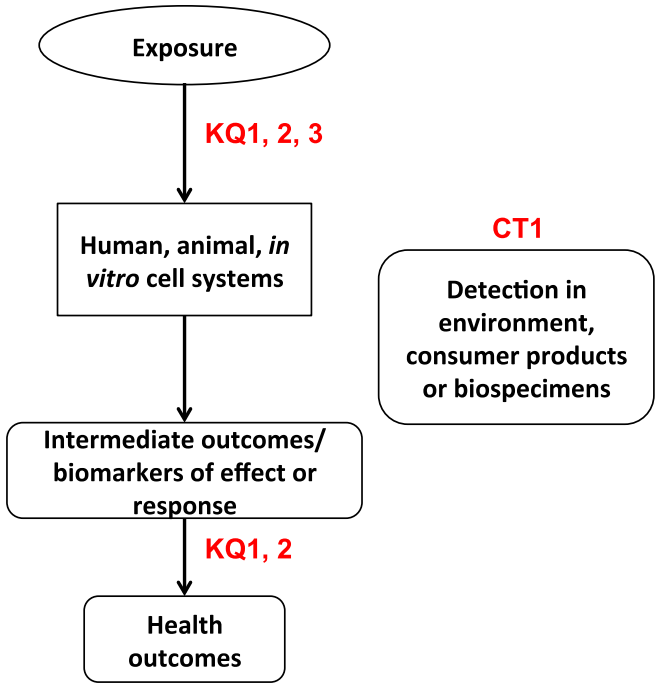


Table 3. Key Questions	
Key Questions (KQ): Systematically reviewed	
KQ1	What is the current extent of the human health effects literature for the 24 BPA analogues listed in **Table 1**?
KQ2	What is the current extent of the animal health effect literature for the 24 BPA analogues listed in **Table 1**?
KQ3	What is the current extent of the mechanistic *in vitro* literature for the 24 BPA analogues listed in **Table 1**?
Contextual Topics (CT): Not systematically reviewed*	
CT1	What is the use, production, and/or description of current levels of exposure for the 24 BPA analogues listed in Table 1?

*Contextual topics provide background information to support the rationale or conduct of the systematic review but are not study questions addressed in the systematic review (USPSTF 2011). Sources of information for contextual questions include (1) targeted literature searches, (2) secondary reviews, (3) expert input, or (4) reports identified during the comprehensive literature screening for the key questions.

METHODS

Step 1. Problem Formulation

Selection of BPA analogues for systematic review and similarity profiling

A list of 64 BPA structural and/or functional analogues was developed based on (1) inclusion in previous government documents relating to BPA and/or BPS structural and/or functional analogues (NTP 2013, US EPA 2014); (2) chemicals identified while reviewing literature; and/or (3) having structural or similarity to BPA or those BPA analogues previously detected in the environment (Cacho *et al.* 2012, Liao *et al.* 2012b, Liao *et al.* 2012e, Liao and Kannan 2013) (**Appendix Table 1**). This list was shared and discussed with internal collaborators and external partners at US EPA's DfE Program and at California EPA Office of Environmental Health Hazard Assessment. Based on these discussions, twenty-seven BPA structural and/or functional analogues were prioritized for inclusion in the systematic review based on (1) detection in the environment (e.g., dust, water, sewage), foodstuff, or human biological samples or (2) identification by the U.S. EPA DfE program as being a potential alternative to BPA in thermal paper (US EPA 2014).

A literature search strategy was developed for the 27 chemicals (described in more detail below) and search results were screened at the title and abstract level in order to identify the extent of information available for each compound. The initial inventory of available literature within the different evidence streams for each of the 27 BPA analogues is presented in **Table 4**. Upon review of the initial inventory a decision was made to focus data extraction efforts on those 24 chemicals that are "data poor," defined as not having been the subject of previous reviews or risk assessments and therefore could be considered "emerging" chemicals of interest. A bibliographic list for the "data rich" chemicals (TBBPA, TCBPA, PHBB) will be included in the systematic review as a supplemental material.

Table 4. Initial inventory of available literature on 27 BPA analogues			
	Evidence Stream		
Chemical	Human Health	Animal Toxicity	Mechanistic
TBBPA	7	>200	>150
PHBB	17	13	44
BPF*	9	9	26
TCBPA	0	12	26
BPS	0	4	21
BPAF	0	5	17
BPB	0	3	13
BPC	0	2	8
BPE	0	1	5
BPZ	0	1	4
TMBPA	0	3	2
BPP	0	0	3
2,4-BPS	0	1	1
BPAP	0	0	2
BDP	0	0	0
BPPH	0	0	0
BPS-MAE	0	0	0
BPS-MPE	0	0	0
BTUM	0	0	0
D-8	0	0	0
D-90	0	0	0
DD-70	0	0	0
MBHA	0	0	0
Pergafast 201	0	0	0
TGSA	0	0	0
UU	0	0	0
*BPF	It is not possible at this point to distinguish between 2,2-BPF and 4,4-BPF		

Step 2: Search For and Select Studies for Inclusion

Literature search strategy

For each of the 27 BPA analogues, SciFinder was searched using the analogue's Chemical Abstract Services Registry Number (CASRN) to retrieve synonym names as well as old or additional CASRNs. In addition, a broader search of the literature on bisphenol A analogues in general was done in order to retrieve articles that had not specified analogues in the title or abstract. No publication year limits were imposed and the final search was run on March 23, 2015. The search strategy was customized for each database because of differences in syntax. For example, Embase does not recognize a square bracket; therefore, a chemical name such as 2-[(4-Hydroxyphenyl)sulfonyl]phenol needed to be converted to 2-((4-hydroxyphenol)sulfonyl)phenol.

For some analogues, the abbreviations were often synonyms for other concepts and resulted in high results. For example, the abbreviation "Bis-Z" for Bisphenol Z retrieved either German "A bis Z" or other chemical names that included "Bis[(Z" and the abbreviation for another analogue, "MBHA," is used for numerous other concepts and when searched only retrieved irrelevant results. In order to increase the relevancy of the results in these circumstances, an initial search was done just on the abbreviation. If even one relevant record was retrieved, then the abbreviation would be included in the search. Otherwise, the abbreviation was excluded. If an abbreviation was included and retrieved over 25 results, then the records were refined by subject area when possible in Scopus and Web of Science. See **Appendix 2** for caveats about searching chemicals in each database, the search strategy used, and number of results retrieved.

Databases Searched

Literature search strategies were developed to identify all relevant published evidence as described above. Six electronic databases were searched:

- PubMed
- EMBASE
- Scopus
- Web of Science
- SciFinder
- Toxline

Searching Other Resources

We will use the following methods to find additional studies that were not identified through the electronic searches. Studies will be evaluated using the same inclusion and exclusion criteria as used for screening records retrieved from the electronic search. Relevant studies identified through these steps will be marked as "provided from other sources" in the study selection flow diagram.

- Grey literature: To ensure retrieval of the relevant literature, OHAT may try to identify relevant "grey literature," which refers to publications that are not commercially published or are not readily publicly available. For this report we considered the US EPA's Design for the Environment assessment on alternatives to BPA in thermal paper (US EPA 2014) and NTP's Draft Summary of Endocrine Disruption Literature for Bisphenol A Analogs and Derivatives Supporting Nomination for Toxicological Evaluation by the National Toxicology Program (NTP

2013). These documents were used for background information and their reference lists were reviewed for relevant studies that may have been missed by the literature search.
- Public input: Studies identified by the public when the initial list of included studies is posted on the OHAT website (anticipated for April 2015) (http://ntp.niehs.nih.gov/go/evals). Studies identified within 30 days of posting will be considered for inclusion.

Protocol Revision 8/18/15

Previously there were two bullet points regarding searching other resoucres that read:

- References and citations from included studies: The informationist will use Web of Science and Scopus to capture the references cited in the included studies as well as the publications that cite them. The additional references will be compared against the original search result set and any duplicates removed.
- References and citations from relevant reviews, commentaries, or other non-research articles: The informationist will use Web of Science and Scopus to capture the references cited in the lists of relevant reviews, commentaries, or other non-research articles. Commentaries or letters on specific studies are also reviewed to see if they contain content that should be noted during data extraction or risk of bias assessment of the original report.

These bullet points will henceforth be removed from the protocol. Web of Science was used to capture the references contained in and citations of a near final list of 118 included studies in December 2014. This search resulted in retrievel of over 4,054 unique studies that had not been captured in the original search. These studies were explored by searching for keywords such as “bisphenol” and “analogue” using the search feature in Endnote. It appeared that the vast majority of the records were not relevant for the current review. We felt that by performing a literature update in March 2015 would capture any relevant studies that had cited those from the list of included studies and did not pursue title and abstract screening of the 4,054 studies identified from this Web of Science search.

Treatment of Special Content Types

- Non-English studies: These studies will only advance to full-text review if the title and/or abstract are available in English, it is sufficiently detailed to make an eligibility determination, and if review of the available information suggests that the article contains original data that are directly relevant. They will be excluded if the title and/or abstract are very general or too vague to make an eligibility determination.
- Unpublished data: Unpublished data that may be critical to the evaluation and is not peer reviewed will be included if the owners of the data are willing to have the study details and results made publicly accessible. In this case, NTP will obtain external peer review as outlined in the OHAT Systematic Review Handbook.
- Database content: NTP’s Tox21 and EPA’s ToxCast high throughput screening platforms will be assessed and analyses will be made to compare structural and biological similarity of the BPA analogues to each other, to BPA, and to BPA or other reference compounds such as the potent synthetic estrogen ethinyl estradiol (EE_2).
- Conference abstracts, grant awards, and thesis/dissertations: These will not be included unless criteria described above for unpublished data have been met.

Protocol Revision 8/18/15

- The list of Registered Substances contained in the REACH (Research, Evaluation, Authoricastion, Restriction) Database maintained by ECHA (Europeach Chemicals Agency) will be searched by CASRN for each of the 24 included BPA analogues. The studies listed for each chemical will be provided in a final list of included studies. Because it is publicaly available data, key data elements will be extracted either directly from the provided studies or, when available, in summary form from the US EPA's Design for the Environment assessment on alternatives to BPA in thermal paper (US EPA 2014).

Screening Process

DistillerSR®, a web-based, systematic review software program with structured forms and procedures will be used to screen articles for relevance and eligibility to ensure standardization of process. Initially, results of the literature search are assembled in EndNote software and exact article duplicates removed prior to uploading the references into the systematic review software program.

In order to be eligible for inclusion, studies must comply with the criteria specified by the PECO statement (**Table 2**). Studies that do not meet the PECO statement will be excluded. Some articles may be categorized as possible supportive material if they appear inappropriate for inclusion, but appear to contain relevant background information. Inclusion and exclusion criteria used to screen articles for relevance and eligibility at both the title-and-abstract and full-text screening stages are detailed in **Table 5**. The main reason for exclusion at the full-text-review stage will be annotated and reported in the study flow diagram.

Title/Abstract Review

Two members of the evaluation design team will independently conduct a title and abstract screen of the search results to determine whether a reference meets the inclusion criteria; studies that are not excluded based on the title and abstract will be screened through a full-text review. Screeners will be trained using project-specific written instructions with an initial pilot phase undertaken to improve clarity of the inclusion and exclusion instructions and to improve accuracy and consistency among screeners.

Studies are not considered further when the title or abstract clearly indicate that the study does not meet the inclusion criteria. For citations where the database contains no abstract, articles will be screened based on title relevance, page numbers (articles of less than ≤2 page length will assumed to be conference reports, editorials, or letters), and PubMed MeSH headings. In case of screening conflicts, screeners will independently review their screening results to confirm the inclusion/exclusion decision and, if needed, discuss discrepancies with the other screener(s). During the screening process, studies will be broadly categorized by evidence stream (human, animal, mechanistic), type of health outcome, and chemical (**Table 4**).

Full-Text Review

After completion of the title/abstract screen, full-text articles are retrieved[1] for those studies that either clearly meet the inclusion criteria or where eligibility to meet the inclusion criteria is unclear. Full-text review will be conducted by one member of the review team with a second member of the team confirming the exclusion determination of the first reviewer. True disagreements will be resolved by discussion involving another member(s) of the team or, if necessary, through consultation with technical advisors.

Table 5. Inclusion and exclusion criteria to determine study eligibility

Inclusion Criteria	Exclusion Criteria
Population (human studies or experimental model systems)	
• Human studies.	• No exclusions.
• Non-human studies. • Mechanistic studies.	• Plant studies. • Studies with *in silico* outcomes only.
Exposure	
• Any measurement of exposure is included. This could include biomonitoring data (e.g., urine, blood, or other specimens), environmental measurements (e.g., air, water levels), indirect measures such as job exposure matrix (title; or the intervention). • Any exposure to a single compound is included. • Any exposure to a single compound in the presence of positive control compound (e.g., compound plus estradiol to evaluate antagonistic activity).	• Exposure to more than one compound (e.g., chemical mixture studies). • Exposure to resins containing compounds of interest.
Comparators	
• Unexposed or lowest exposure group as the referent group (e.g., NHANES type analyses). Note: some studies will not have a comparison group, e.g., pharmacokinetic studies. • Vehicle control or lowest exposure group for observational (wildlife) animal studies.	• No exclusions.
• Vehicle control or lowest exposure group for observational (wildlife) animal studies • Vehicle control for mechanistic studies.	• No exclusions.

[1] OHAT will initially attempt to retrieve a full-text copy of the study using an automated program, such as QUOSA, when possible, and NIH library services (NIH subscriptions and interlibrary loans). For publications not available through NIH, OHAT will search the Internet and/or may attempt to contact the corresponding author. Studies not retrieved through these mechanisms are excluded and notated as "not available."

Table 5 (Continued)	
Inclusion Criteria	**Exclusion Criteria**
Outcomes	
• Health outcome required, but no restrictions on the type of health outcome reported. All health outcomes and biological effects are included.	• Lacks health outcome (e.g., metabolism of compound, biomonitoring only). • Studies with *in silico* outcomes only. • Studies that only have information on the analytical chemistry, polymer science and/or chemical characterization and physical properties. • Studies that only have information on the synthetic process used to produce the chemical. • Studies that only have information on the companies that supply the chemical. • Studies that only have information pertaining to use as dental amalgams/resins/sealants.

Multiple publications of same data

Multiple publications with overlapping data for the same study may be identified by examining author affiliations, study designs, and results. If necessary, study authors will be contacted to clarify any uncertainty about the independence of two or more articles. OHAT will include all publications on the study, select one study to use as the primary, and consider the others as secondary publications with annotation as being related to the primary record during data extraction. The primary study will generally be the publication with the most recent publication date. OHAT will include relevant data from all publications of the study, although if the same outcome is reported in more than one report, OHAT will exclude the duplicate data.

Tracking study eligibility and reporting the flow of information

The main reason for exclusion at the full-text-review stage will be annotated and reported in a study flow diagram in the final report. Commonly used categories for exclusion include: (1) is a review, commentary, or letter with no original data; (2) lacks relevant exposure information; (3) lacks relevant health outcome information; and (4) is a conference abstract, thesis/dissertation.

Step 3: Extract Data from Studies

Data Extraction Process and Data Warehousing

Data extraction will be managed with structured forms and study information stored in a database format using ICF International's proprietary DRAGON software[2]. The content of the data extraction may

[2] DRAGON (Dose Response Analytical Generator and Organizational Network) developed by ICF International. http://www.icfi.com/insights/products-and-tools/dragon-dose-response.

be revised following the identification of the studies included in the review. Study information collected during data extraction will be visualized and made publicly available upon publication of the manuscript using HAWC, an open source and freely available web-based interface application[3].

The majority of data extraction will be conducted by ICF International. At a minimum, two reviewers will work independently to extract quantitative and other critical data from each study (see **Table 6** for data extraction elements for animal and *in vitro* studies). One reviewer enters the data from included articles and another member of the review team checks the extracted study information against the accompanying article(s) for completeness and accuracy as a quality control measure. The project lead (K.P.) will also review the extracted data for completeness. Data extractors from the evaluation team will be trained using project-specific written instructions in an initial pilot phase using a subset of studies. This pilot testing will be performed with all team members that will be involved in data extraction such that everyone data extracts the same reference or set of references.

Discrepancies during data extraction are initially discussed by extractors and the project lead, or if necessary, consultation with technical advisors to resolve disagreements. Information that is inferred, converted, or estimated during data extraction will be marked by brackets, e.g., [n=10].

OHAT will attempt to contact authors of included studies to obtain missing data considered important for evaluating key study findings or risk of bias (e.g., level of data required to conduct a meta-analysis). The evaluation report will note that an attempt to contact study authors was unsuccessful if study researchers do not respond to an email or phone request within one month of the attempt to contact.

Table 6. Key data extraction elements to summarize study design, model, methodology, and results

HUMAN	
funding	Funding source(s)
	Reporting of conflict of interest (COI) by authors
subjects	Dates of study and sampling time frame
	Demographics (sex, race/ethnicity, age or lifestage at exposure and outcome assessment)
	Number of subjects (target, enrolled, n per group in analysis, and participation/follow-up rates)

[3] HAWC (Health Assessment Workspace Collaborative): A Modular Web-based Interface to Facilitate Development of Human Health Assessments of Chemicals. https://hawcproject.org/portal/.

Table 6 (continued)	
methods	Study design (e.g., prospective or retrospective cohort, nested case-control study, cross-sectional, population based case-control, intervention, case report, etc.)
	Length of follow-up/duration of exposure
	Health outcome category, e.g., cardiovascular
	Health outcome, e.g., blood pressure
	Substance name and CASRN
	Exposure assessment (e.g., blood, urine, hair, air, drinking water, job classification, residence, administered treatment in controlled study, etc.)
	Statistical methods
results	Exposure levels (e.g., mean, median, measures of variance as presented in paper such as SD, SEM, 75th/90th/95th percentile, minimum/maximum); range of exposure levels, number of exposed cases
	Statistical findings (e.g., adjusted β, standardized mean difference, adjusted odds ratio, standardized mortality ratio, relative risk, etc.) or description of qualitative results
other	Documentation of author queries, use of digital rulers to estimate data values from figures, exposure unit, and statistical result conversions, etc.
ANIMAL	
funding	Funding source(s)
	Reporting of COI by authors
animal model	Sex
	Species
	Strain
	Age or life stage at start of dosing and health outcome assessment
treatment	Chemical name and CASRN
	Source of chemical
	Purity of chemical
	Dose levels or concentration (as presented and converted to mg/kg bw/d when possible)
	Other dose-related details such as whether administered dose level was verified by measurement, information on internal dosimetry
	Vehicle used for exposed animals
	Route of administration (e.g., oral, inhalation, dermal, injection)
	Duration and frequency of dosing (e.g., hours, days, weeks when administration was ended, days per week)

Table 6 (continued)	
methods	Study design (e.g., single treatment, acute, subchronic, chronic, multigenerational, developmental, other)
	Number of animals per group (and dams per group in developmental studies)
	Randomization procedure
	Method to control for litter effects in developmental studies
	Use of negative controls and whether controls were untreated, vehicle-treated, or both
	Endpoint health category (e.g., reproductive)
	Endpoint (e.g., infertility)
	Diagnostic or method to measure endpoint
	Statistical methods
results	Measures of effect at each dose or concentration level (e.g., mean, median, frequency, and measures of precision or variance) or description of qualitative results. When possible, OHAT will convert measures of effect to a common metric with associated 95% confidence intervals (CI). Most often, measures of effect for continuous data will be expressed as mean difference, standardized mean difference, and percent control response. Categorical data will be expressed as relative risk (RR, also called risk ratio).
	No Observed Effect Level (NOEL), Lowest Observed Effect Level (LOEL), benchmark dose (BMD) analysis, statistical significance of other dose levels, or other estimates of effect presented in paper
	When possible, statistical power is assessed during data extraction using an approach to assess ability to detect a 10- 20% change from control group's response for continuous data or relative risk or odds ratio of 1.5-2 for categorical data using the outcome frequency in the control group to determine sample size. Recommended sample sizes will be compared to sample sizes used in the study to categorize statistical power as "appears to be adequately powered" (sample size met), somewhat underpowered (sample size is 75% to <100% of recommended), "underpowered" (sample size is 50% to <75% required), or "severely underpowered (sample size is <50% required).
	Observations on dose response (e.g., trend analysis, description of whether dose-response shape appears to be monotonic, non-monotonic)
	Data on internal concentration, toxicokinetics, or toxicodynamics (when reported)
other	Documentation of author queries, use of digital rulers to estimate data values from figures, exposure unit, and statistical result conversions, etc.

Table 6 (continued)	
IN VITRO	
funding	Funding source(s)
	Reporting of COI by authors
cell/tissue	Cell line, cell type, or tissue
model	Source of cells/tissue
	Sex
	Species
	Strain
treatment	Chemical name and CASRN
	Concentration levels [as presented and converted to µM when possible]
	Source of chemical
	Purity of chemical
	Vehicle used for experimental conditions
	Duration and frequency of dosing (e.g., hours, days, weeks when administration was ended, times per day or week)
methods	Number of replicates per group
	Percent serum/plasma in medium
	Use of negative controls and whether controls were untreated or vehicle-treated
	Whether expected response was observed in positive controls
	Endpoint health category (e.g., estrogen agonist or antagonist activity)
	Endpoint or assay target (e.g., estrogen receptor activation)
	Diagnostic or method to measure endpoint (e.g., reporter gene assay)
	Statistical methods
results	No Observed Effect Concentration (NOEC), Lowest Observed Effect Concentration (LOEC), statistical significance of other concentration levels, AC50, or and other estimates of effect presented in paper
	Observations on dose response (e.g., trend analysis, description of whether dose-response shape appears to be monotonic, non-monotonic)
other	Documentation of author queries, use of digital rulers to estimate data values from figures, exposure unit, and statistical result conversions, etc.

Step 4: Quality Assessment of Individual Studies

Internal Validity ("Risk of bias")

Internal validity or risk of bias will be assessed for individual studies using a tool developed by OHAT that outlines a parallel approach for evaluating risk of bias from human or animal studies to facilitate consideration of risk of bias across evidence streams with common terms and categories. The risk-of-bias tool is comprised of a common set of 11 questions that are answered based on the specific details of individual studies to develop risk-of-bias ratings (using the four options in **Table 6**) for each question.

Study design determines the subset of questions that should be used to assess risk of bias for an individual study (**Table 7**). For example, the subset of risk-of-bias questions applicable to all of the experimental study designs includes a question on randomization of exposure that would not be applicable to observational study designs. Therefore, a similar set of questions is used across experimental study designs (experimental animal and human controlled trials).

Table 7: Answers to the Risk-of-Bias Questions Result in One of Four Risk-of-Bias Ratings	
++	***Definitely Low*** *risk of bias:* There is direct evidence of low risk-of-bias practices
+	***Probably Low*** *risk of bias:* There is indirect evidence of low risk-of-bias practices **OR** it is deemed that deviations from low risk-of-bias practices for these criteria during the study would not appreciably bias results, including consideration of direction and magnitude of bias
– NR	***Probably High*** *risk of bias*: There is indirect evidence of high risk-of-bias practices (indicated with "-") **OR** there is insufficient information provided about relevant risk of bias practices (indicated with "NR" for not reported). Both symbols indicate probably high risk of bias.
––	***Definitely High*** *risk of bias:* There is direct evidence of high risk-of-bias practices

Studies are assessed by one assessor and independently reviewed by a second assessor who answer all applicable risk-of-bias questions with one of four options in **Table 6** (answers from CLARITY Group at McMaster University 2013) following pre-specified criteria detailed in **Appendix 3**. The criteria describe aspects of study design, conduct, and reporting required to reach risk-of-bias ratings for each question and specify factors that can distinguish among ratings (e.g., what separates "definitely low" from "probably low" risk of bias). The instructions and detailed criteria are tailored to the specific evidence stream and type of human study designs. Risk of bias will be assessed at the outcome level because study design or method specifics may increase the risk of bias for some outcomes and not others within the same study. For studies in humans, risk of bias will only be assessed if there are three or more reports on the same chemical with similar health effects. Risk of bias will not be assessed for *in vitro* or mechanistic data in this review due to a lack of a published method for evaluating risk of bias in these types of studies.

Table 8: OHAT Risk-of-Bias Questions and Applicability by Study Design						
Risk-of-Bias Questions	**Experimental Animal***	**Human Controlled Trials****	**Cohort**	**Case-Control**	**Cross-Sectional*****	**Case Series**
1. Was administered dose or exposure level adequately randomized?	X	X				
2. Was allocation to study groups adequately concealed?	X	X				
3. Did selection of study participants result in the appropriate comparison groups?			X	X	X	
4. Did study design or analysis account for important confounding and modifying variables?			X	X	X	X
5. Were experimental conditions identical across study groups?	X					
6. Were research personnel blinded to the study group during the study?	X	X				
7. Were outcome data complete without attrition or exclusion from analysis?	X	X	X	X	X	
8. Can we be confident in the exposure characterization?	X	X	X	X	X	X
9. Can we be confident in the outcome assessment (including blinding of outcome assessors)?	X	X	X	X	X	X
10. Were all measured outcomes reported?	X	X	X	X	X	X
11. Were there no other potential threats to internal validity?	X	X	X	X	X	X

*Experimental animal studies are controlled exposure studies. Non-human animal observational studies can be evaluated using the design features of observational human studies such as cross-sectional study design. **Human Controlled Trials are studies in humans with controlled exposure (e.g., Randomized Controlled Trials, non-randomized experimental studies)

***Cross-sectional studies include population surveys with individual data (e.g., NHANES) and surveys with aggregate data (i.e., ecological studies).

Risk-of-Bias Assessment Process

Assessors will be trained using the criteria in **Appendix 3** with an initial pilot phase undertaken to improve clarity of criteria that distinguish between adjacent ratings and to improve consistency among assessors. All team members involved in the risk-of-bias assessment will be trained on the same set of studies and asked to identify potential ambiguities in the criteria used to assign ratings for each question. Any ambiguities and rating conflicts will be discussed relative to opportunities to refine the criteria to more clearly distinguish between adjacent ratings. If major changes to the risk-of-bias criteria are made based on the pilot phase (i.e., those that would likely result in revision of response), they will be documented in a protocol amendment along with the date modifications were made and the logic for the changes. It is also expected that information about confounding, exposure characterization,

outcome assessment, and other important issues may be identified during or after data extraction, which can lead to further refinement of the risk-of-bias criteria (Sterne *et al.* 2014).

After assessors have independently made risk-of-bias determinations for a study across all risk-of-bias questions, the two assessors will compare their results to identify discrepancies and attempt to resolve them. Any remaining discrepancies will be considered by the project lead and, if needed, other members of the evaluation design team and/or technical advisors. The final risk-of-bias rating for each question will be recorded along with a statement of the basis for that rating. The risk-of-bias assessment of included studies will be part of the study summaries released in materials for the draft state-of-the-science report that will be posted for public comment prior to peer review (anticipated for September 2015). Peer review will provide an opportunity for investigators and the public to comment on the risk-of-bias analysis.

Missing Information for Risk of Bias Assessment

OHAT will attempt to contact the corresponding author of included studies by email to obtain missing information considered critical for evaluating risk of bias that cannot be inferred from the study. If no response is received within two weeks, they will be contacted again by email. In the event of no response after a second attempt then the data will be considered "not reported." If additional information or data are received from study authors, risk-of-bias judgments will be modified to reflect the updated study information. If OHAT does not receive a response from the authors by one month of the contact attempt, a risk of bias response of "NR" for "not reported; probably high risk of bias" will be used and a note made in the data extraction files that an attempt to contact the authors was unsuccessful.

Step 5. Evidence Integration and Similarity Profiling

Initial screening of the literature during problem formulation showed that for most of the chemicals included in the review there were no, or very few, animal or human studies available. Human studies relate to dermal irritation and most studies utilize *in vitro* models. OHAT does not currently have a framework developed for reaching confidence or hazard conclusions based solely on *in vitro* data. Thus, the evaluation will not attempt to rate the confidence in the body of evidence or to integrate the human, animal and/or mechanistic data to reach formal NTP level of evidence or hazard conclusions. Given that the objective of this review is to synthesize and summarize the exisiting evidence for biological activity of the BPA analogues, hazard identification will not be pursued for any specific chemical in the event that additional human or animal studies are identified beyond those found during the initial screening. However, this does not preclude the possibility that future systematic reviews could be conducted on specific chemicals should enough evidence be identified to merit such activities.

The goal of our analysis is to identify areas of consistency, uncertainty, and data gaps that could be addressed by further research. Specifically:

- Patterns of findings will be evaluated for consistency across studies, shape of dose-response, and potency relative to BPA or other reference compounds such E2 or the potent synthetic estrogen ethinyl estradiol (EE2).
- The structural and biological similarity of the analogues to each other, to BPA, and to potent estrogens E2 and/or EE2 within the National Toxicology Program's (NTP) Tox21 and U.S. Environmental Protection Agency's (US EPA) ToxCast high throughput screening (HTS) platforms will be evaluated, and;

- Network analysis will be conducted to identify chemicals most biologically similar to the BPA analogues in Tox21.

Structural Similarity Within HTS Data

Leadscope Model Applier (Leadscope Inc., Columbus, OH, USA) was used to calculate the presence or absence of 27,000 possible structural features for each chemical in the HTS library and a Tanimoto correlation score was then calculated. A Tanimoto correlation score quantifies the relationship between two strings of features (in this case chemical substructure features) which have binary attributes (i.e,. 0= does not have substructure; 1=has substructure). In order to visualize the Tanimoto correlation scores between either BPA or EE_2 and the 13 BPA analogues tested in Tox21 the chemicals were plotted on a linear scale from 0 to 1 such that values = 1 are perfectly correlated and values >1 indicate decreasing similarity.

Biological Similarity Within HTS Data

Biological similarity profiling assesses how each chemical performs across all of the assays in the HTS platform. We used complimentary approaches to evaluate HTS findings. First, biological activity was assessed using clustering techniques based on the point of departure (POD), which is one estimate of chemical potency. This is the concentration at which a biological response is first detected in the assay system. A heatmap was created with the various BPA analogues, BPA and EE_2 on the horizontal axis and the endocrine-related, stress, or DNA damage assays for which one or more BPA analogue was considered active on the y-axis. This analysis highlighted how similar, biologically, the BPA analogues were to each other and/or to BPA and EE_2. Second, biological activity across the HTS assays was visualized using a ToxPI analysis based on the weighted area under the curve (wAUC) (Reif *et al.* 2013). In this analysis the height of the pie slice for each assay category indicates how active that chemical is for that type of assay relative to the most active chemicals with the library. The wAUC measurement considers both the efficacy and the potency parameters and is reflective of the total elicited effect across concentrations tested. Third, the log transformed 50% activity values (pAC_{50}) across the various HTS assays for each BPA analogue were correlated with those of BPA or EE_2 using a matrix Pearson correlation analysis performed in Partek Genomics Suite 6.6 (Partek, Inc., St. Louis, MO, USA). As in the analysis of structural similarity, the correlation was plotted on a linear scale from 0 to 1 such that values = 1 were perfectly correlated and values >1 indicated decreasing similarity. Finally, a correlation network with threshold R=0.7 was drawn using Cytoscape software (version 3.1.1) (Shannon *et al.* 2003) to describe chemicals that responded to the HTS assays similarly to BPA. The "nearest neighbors" to these chemicals were then identified. This analysis identified a network of chemicals correlated to BPA at the 0.7 level. When possible, identical analyses were performed in ToxCast™, which has assays that assess a wider array of biological space than Tox21, but included fewer BPA analogues (n=4).

STATE-OF-THE-SCIENCE REPORT FORMAT

The NTP state-of-the-science report on BPA analogues of emerging public health concern will include the following information:

Introduction

This section will provide a brief background on the topic.

Methodology

This section will provide a brief overview of the methodologies used in the review process, including:

- the research question;
- the search strategy used to identify and retrieve studies;
- the process for selecting the included studies;
- the methods of data extraction;
- the methods used to assess risk-of-bias of included animal studies;
- the methods used to synthesize the data of included studies

Results

This section will include the results from the state-of-the-science evaluation on BPA analogues of emerging public health concern. Results will be presented in tables or figures as appropriate using HAWC. The results from the included studies will be discussed by outcome. This will include a description of:

- the number of studies identified as relevant;
- full list of excluded studies, with the reasons for exclusion;
- a summary of the results and quality assessment for each included human or animal study (including files in downloadable format); and
- a narrative description of results with figures

Discussion

The discussion will provide a summary of the review findings, including a discussion of any data gaps identified in the evidence and any suggestions of areas for further research. Any important limitations of the review will be described and their impact on the available evidence will be discussed.

REFERENCES

Becerra V, Odermatt J. 2013. Interferences in the direct quantification of bisphenol S in paper by means of thermochemolysis. *Journal of chromatography. A* 1275: 70-77.

Brehler R, Theissen U, Mohr C, Luger T. 1997. "Latex-fruit syndrome": frequency of cross-reacting IgE antibodies. *Allergy* 52(4): 404-410.

Cacho JI, Campillo N, Vinas P, Hernandez-Cordoba M. 2012. Stir bar sorptive extraction coupled to gas chromatography-mass spectrometry for the determination of bisphenols in canned beverages and filling liquids of canned vegetables. *Journal of chromatography. A* 1247: 146-153.

Calafat AM, Ye X, Wong LY, Reidy JA, Needham LLCINEHPJ, a P. 2008. Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004. *Environmental health perspectives* 116(1): 39-44.

CLARITY Group at McMaster University. 2013. *Tools to assess risk of bias in cohort studies, case control studies, randomized controlled trials, and longitudinal symptom research studies aimed at the general population*. Available: http://www.evidencepartners.com/resources/ [accessed 15 January 2013].

Cobellis L, Colacurci N, Trabucco E, Carpentiero C, Grumetto L. 2009. Measurement of bisphenol A and bisphenol B levels in human blood sera from endometriotic women. *Biomedical Chromatography* 23(11): 1186-1190.

Cobellis L, Panariello A, Campitiello MR, Nocerino A, Pacilio C, Salzillo ME, Castaldi MA, Boccia O, Borrelli A. 2010. Relationship between endometriosis and exposure to BPA and BPB. *Relazione tra esposizione a bisfenolo A e B ed endometriosi* 32(1): 44-48.

Cunha SC, Fernandes JO. 2010. Quantification of free and total bisphenol A and bisphenol B in human urine by dispersive liquid-liquid microextraction (DLLME) and heart-cutting multidimensional gas chromatography-mass spectrometry (MD-GC/MS). *Talanta* 83(1): 117-125.

EFSA. 2013. *Public consultation on the draft opinion on bisphenol A (BPA) – exposure assessment [314 pages]* http://www.efsa.europa.eu/en/consultations/call/130725.htm *[accessed 23 August 2013]*. Authority EFS.

FAO/WHO. 2011. Joint Food and Agriculture Organization of the United Nations and World Health Organization (FAO/WHO) expert meeting to review toxicological and health aspects of bisphenol A: Final report, including report of stakeholder meeting on bisphenol A, 1-5 November 2010, Ottawa, Canada. http://www.who.int/foodsafety/chem/chemicals/bisphenol/en/ [accessed 25 July 2013].

Finish Institute of Occupational Health (FIOH). 2014. Bisphenol A exposure in Finnish workplaces (April 10, 2014). Available: http://www.ttl.fi/fi/verkkokirjat/Sivut/Bisfenoli.aspx [accessed 10 July 2014].

Food and Drug Administration (FDA). 2012. Indirect Food Additives: Polymers. Final Rule. 77 FR 41899 (July 17, 2012). http://www.gpo.gov/fdsys/pkg/FR-2012-07-17/html/2012-17366.htm [accessed 25 July 2013].

Food and Drug Administration (FDA). 2013. Indirect Food Additives: Adhesives and Components of Coatings. Final Rule. 78 FR 41840 (July 12, 2013). https://www.federalregister.gov/articles/2013/07/12/2013-16684/indirect-food-additives-adhesives-and-components-of-coatings [accessed 25 July 2013].

Higgins J, Green S. 2011. Cochrane Handbook for Systematic Reviews of Interventions, The Cochrane Collaboration.

Liao C, Liu F, Alomirah H, Loi VD, Mohd MA, Moon HB, Nakata H, Kannan K. 2012a. Bisphenol S in urine from the United States and seven Asian countries: occurrence and human exposures. *Environ Sci Technol.* 46(12): 6860-6866.

Liao C, Liu F, Guo Y, Moon HB, Nakata H, Wu Q, Kannan K. 2012b. Occurrence of eight bisphenol analogues in indoor dust from the United States and several Asian countries: implications for human exposure. *Environ Sci Technol.* 46(16): 9138-9145.

Liao C, Liu F, Kannan K. 2012d. Bisphenol S, a new bisphenol analogue, in paper products and currency bills and its association with bisphenol A residues. *Environ Sci Technol.* 46(12): 6515-6522.

Liao C, Liu F, Moon HB, Yamashita N, Yun S, Kannan K. 2012e. Bisphenol analogues in sediments from industrialized areas in the United States, Japan, and Korea: spatial and temporal distributions. *Environ Sci Technol.* 46(21): 11558-11565.

Liao C, Kannan K. 2013. Concentrations and profiles of bisphenol A and other bisphenol analogues in foodstuffs from the United States and their implications for human exposure. *Journal of agricultural and food chemistry* 61(19): 4655-4662.

Liao C, Kannan K. 2014. A Survey of Alkylphenols, Bisphenols, and Triclosan in Personal Care Products from China and the United States. *Arch Environ Contam Toxicol*.

National Toxicology Program (NTP). 2008. NTP-CERHR Monograph on the Potential Human Reproductive and Developmental effects of Bisphenol A. *NTP CERHR Monograph Series*(22): v, vii-ix, 1-64 passim http://ntp.niehs.nih.gov/ntp/ohat/Bisphenol/Bisphenol.pdf [accessed 23 July 2013].

NTP. 2013. *Draft Summary of Endocrine Disruption Literature for Bisphenol A Analogs and Derivatives Supporting Nomination for Toxicological Evaluation by the National Toxicology Program (February 2013)*. Program NT.

Östberg T, Noaksson E. 2010. Bisfenol A in Svenska Kvitton. Analysresultat. Institutet för Tillämoa Grön Kemi, Jämtlands läns Landsting. http://www.jegrelius.se/images/stories/nyheter/Bisfenol_A_i_svenska_kvitton_Jegrelius_101013.pdf (accessed 8 July 2013; translated from Swedish to English using Google translator).

Reif DM, Sypa M, Lock EF, Wright FA, Wilson A, Cathey T, Judson RR, Rusyn I. 2013. ToxPi GUI: an interactive visualization tool for transparent integration of data from diverse sources of evidence. *Bioinformatics* 29(3): 402-403.

Rochester JR. 2013. Bisphenol A and human health: a review of the literature. *Reproductive toxicology (Elmsford, N.Y.)* 42: 132-155.

Rochester JR, Bolden AL. 2015. Bisphenol S and F: A Systematic Review and Comparison of the Hormonal Activity of Bisphenol A Substitutes. *Environmental health perspectives*.

Shannon P, Markiel A, Ozier O, Baliga NS, Wang JT, Ramage D, Amin N, Schwikowski B, Ideker T. 2003. Cytoscape: a software environment for integrated models of biomolecular interaction networks. *Genome Res* 13(11): 2498-2504.

Sterne J, Higgins J, Reeves B, on behalf of the development group for ACROBAT-NRSI. 2014. *A Cochrane Risk Of Bias Assessment Tool: for Non-Randomized Studies of Interventions (ACROBAT-NRSI), Version 1.0.0*. Available: http://www.riskofbias.info [accessed 28 September 2014].

US EPA. 2014. *Bisphenol A alternatives in thermal paper (Final Report January 2014). Available:* http://www.epa.gov/dfe/pubs/projects/bpa/about.htm *[accessed 31 March 2014]*. Agency USEP.

USPSTF (U.S. Preventive Services Task Force). 2011. USPSTF Procedural Manual. AHRQ Publication No. 08-05118-EF. August 2011. http://www.uspreventiveservicestaskforce.org/uspstf08/methods/procmanual.htm [accessed 16 Septmeber, 2014].

vom Saal FS, Akingbemi BT, Belcher SM, Birnbaum LS, Crain DA, Eriksen M, Farabollini F, Guillette LJ, Jr., Hauser R, Heindel JJ, Ho SM, Hunt PA, Iguchi T, Jobling S, Kanno J, Keri RA, Knudsen KE, Laufer H, LeBlanc GA, Marcus M, McLachlan JA, Myers JP, Nadal A, Newbold RR, Olea N, Prins GS, Richter CA, Rubin BS, Sonnenschein C, Soto AM, Talsness CE, Vandenbergh JG, Vandenberg LN, Walser-Kuntz DR, Watson CS, Welshons WV, Wetherill Y, Zoeller RT. 2007. Chapel Hill bisphenol A expert panel consensus statement:

integration of mechanisms, effects in animals and potential to impact human health at current levels of exposure. *Reproductive toxicology (Elmsford, N.Y.)* 24(2): 131-138.

Voordeckers JW, Fennell DE, Jones K, Haggblom MM. 2002. Anaerobic biotransformation of tetrabromobisphenol A, tetrachlorobisphenol A, and bisphenol A in estuarine sediments. *Environmental Science & Technology* 36(4): 696-701.

Ye X, Zhou X, Wong LY, Calafat AM. 2012. Concentrations of bisphenol A and seven other phenols in pooled sera from 3-11 year old children: 2001-2002 National Health and Nutrition Examination Survey. *Environmental science & technology* 46(22): 12664-12671.

Zhou F, Zhang L, Liu A, Shen Y, Yuan J, Yu X, Feng X, Xu Q, Cheng C. 2013. Measurement of phenolic environmental estrogens in human urine samples by HPLC-MS/MS and primary discussion the possible linkage with uterine leiomyoma. *Journal of chromatography. B, Analytical technologies in the biomedical and life sciences* 938: 80-85.

Zhou X, Kramer JP, Calafat AM, Ye X. 2014. Automated on-line column-switching high performance liquid chromatography isotope dilution tandem mass spectrometry method for the quantification of bisphenol A, bisphenol F, bisphenol S, and 11 other phenols in urine. *Journal of chromatography. B, Analytical technologies in the biomedical and life sciences* 944: 152-156.

ABOUT THE PROTOCOL

Contributors

Evaluation team

Evaluation teams are composed of federal staff and contractor staff. Contractor staffs are screened for potential conflicts of interest. Federal staff will do a self-evaluation.

Name	Affiliation
Katherine Pelch, PhD	NIEHS/NTP, Project Lead
Kristina Thayer, PhD	NIEHS/NTP, Director Office of Health Assessment and Translation
Stephanie Holmgren, PhD	NIEHS/OSIM *created and performed literature search*
Vickie Walker	NIEHS/NTP *assisted with literature screening*
Andrew Shapiro, PhD	NIEHS/NTP *assisted with data visualization*
Scott Masten, PhD	NIEHS/NTP *assisted with chemical selection and problem formulation*
Scott Auerbach, PhD	NIEHS/NTP *assisted with chemical selection and problem formulation*
Jui-Hua Hsieh, PhD	NIEHS/NTP *assisted with HTS analyses*
Daniel Svoboda, PhD	NIEHS/NTP *assisted with HTS analyses*
Mike DeVito, PhD	NIEHS/NTP *assisted with HTS analyses*
Sue Fenton, PhD	NIEHS/NTP *assisted with problem formulation*
Vicki Sutherland, PhD	NIEHS/NTP *assisted with problem formulation*
Caroline Baier-Anderson, PhD	US EPA *assisted with chemical selection and problem formulation*
Nathalie Pham, PhD	California Environmental Protection Agency, Office of Environmental Health Hazard Assessment
Shoba Iyer, PhD	California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

Contract support

Contract support will be used to assist in data extraction and risk of bias assessment

Name	Affiliation
Cara Henning	ICF International
Jessica Wignall	ICF International
Pam Ross	ICF International
Robyn Blain	ICF International
Beverly Warden	Social and Scientific Systems, Inc.

Protocol Peer-Reviewers

The peer-reviewers were selected for their experience with BPA, environmental estrogens, cell culture, and/or systematic review procedures. Peer-reviewers were screened for conflict of interest prior to their

service and did not report any conflicts of interest. Service as a peer-reviewer does not necessarily indicate that a reviewer has read the entire protocol or endorses the final document.

Name	Affiliation
Joanna Rochester, PhD	The Endocrine Disruption Exchange (TEDX)
Cheryl Watson, PhD	University of Texas Medical Branch, Biochemistry and Molecular Biology Department

Sources of support

National Institute of Environmental Health Sciences/Division of the National Toxicology Program

Protocol History and Revisions

Date	Activity or revision
May 26, 2015:	**Draft evaluation protocol reviewed:** sent to evaluation design team for comment/review
June 29, 2015, July 13, 2015:	**Draft evaluation protocol reviewed:** sent to technical advisors for comment/review
August 14, 2015:	**Draft evaluation protocol finalized.**
August 18, 2015:	**Two protocol revisions noted.** See "Searching Other Resources" and "Treatment of Special Content Types."

SOFTWARE

The following software programs will be used in this evaluation:

- *DistillerSR®* (http://systematic-review.net/): Systematic review software primarily used to facilitate tracking of studies through the screening process. Includes capabilities for creating forms to help categorize studies or do a basic level of data extraction.
- *DRAGON, Dose Response Analytical Generator and Organizational Network* (http://www.icfi.com/insights/products-and-tools/dragon-dose-response): Software platform that facilitates the conduct of comprehensive human health assessments that require systematic review and synthesis. Includes structured data extraction forms for toxicologic, epidemiologic, and in vitro studies. DRAGON has a modular structure and project management capabilities.
- *Endnote* (http://endnote.com/): Reference management software.
- *HAWC, **H**ealth **A**ssessment **W**orkspace **C**ollaborative (*https://hawcproject.org/portal/*):* A modular, web-based interface that facilitates development of human health assessments of chemicals. Includes capabilities for screening; categorizing studies; preparing reports; carrying out structured data extraction for toxicologic, epidemiologic, and in vitro studies; and enabling interactive, web-based visual displays of data.
- Microsoft Office Suite
- *Quosa Information Manager (http://www.quosa.com)*: Used to manage personal biomedical literature collections including batch retrieval of PDF copies of studies.

- *SWIFT (**S**ciome **W**orkbench for **I**nteractive, Computer-**F**acilitated **T**ext-mining)*: Text mining/machine learning tool to help prioritize literature search results based on test set ("seed" studies); identifies overrepresented words, concepts, and phrases; enables categorization of studies based on sub-topics (i.e., health outcome, chemical, evidence stream).
- *WebPlot Digitizer* (http://arohatgi.info/WebPlotDigitizer/app/): Used to digitally estimate numerical data from graphs presented in included studies.

APPENDICES

Appendix 1. Problem Formulation

A list of 64 chemicals was shared and discussed with internal collaborators and external partners. From this list, 27 chemicals were prioritized for inclusion in the systematic review.

Appendix Table 1. Inital list of chemicals considered for inclusion

Chemical Name	CASRN
N-(p-Toluenesulfonyl)-N'-(3-p-toluenesulfonyloxyphenyl)urea	232938-43-1
4-([4-(Allyloxy)phenyl]sulfonyl)phenol	97042-18-7
Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester	5945-33-5
2,2-Bis(4-hydroxyphenyl)butane	77-40-7
Benzenesulfonamide, N,N'-[methylenebis(4,1-phenyleneiminocarbonyl)]bis[4-methyl-	151882-81-4
Phenol, 4,4'-sulfonylbis-, polymer with 1,1'-oxybis[2-chloroethane] n=1	191680-83-8a
5,5'-(2,2-Propanediyl)di(2-biphenylol)	24038-68-4
Urea-urethane Compound	321860-75-7
Benzeneacetic acid, 4-hydroxy-.alpha.-(4-hydroxyphenyl)-, methyl ester	5129-00-0
Phenol, 2-[(4-hydroxyphenyl)sulfonyl]-	5397-34-2
Phenol, 4,4'-[methylenebis(oxy-2,1-ethanediylthio)]bis-	93589-69-6
Phenol, 4-[[4-(1-methylethoxy)phenyl]sulfonyl]-	95235-30-6
4,4'-(1-Phenyl-1,1-ethanediyl)diphenol	1571-75-1
4,4'-(1,4-Phenylenedi-2,2-propanediyl)diphenol	2167-51-3
Phenol, 4-[[4-(phenylmethoxy)phenyl]sulfonyl]-	63134-33-8
Phenol, 4,4'-sulfonylbis[2-(2-propenyl)-	41481-66-7
Phenol, 4,4'-(1-methylethylidene)bis[2-methyl-	79-97-0
Phenol, 4,4'-methylenebis-	620-92-8
Phenol, 4,4'-(1-methylethylidene)bis[2,6-dibromo-	79-94-7
Benzoic acid, 4-hydroxy-, phenylmethyl ester	94-18-8
Phenol, 4,4'-sulfonylbis-	80-09-1
Phenol, 4,4'-(1-methylethylidene)bis[2,6-dichloro-	79-95-8
Phenol, 2,2'-methylenebis-	2467-02-9
4,4'-(1,1-Ethanediyl)diphenol	2081-08-5
Phenol, 4,4'-(1-methylethylidene)bis[2,6-dimethyl-	5613-46-7
Phenol, 4,4'-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]bis-	1478-61-1

Appendix Table 1 (Continued)	
Chemical Name	**CASRN**
4,4'-(1,1-Cyclohexanediyl)diphenol	843-55-0
4,4'-Bis(2-hydroxyhexafluoroisopropyl)diphenyl ether	2093-04-1
4,4'-(2,2-Dichloroethylidene)diphenol	13005-40-8
Benzoic acid, 4,4'-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis-	1171-47-7
Bis(4-(4-aminophenoxy)phenyl)sulfone	13080-89-2
3'-3"-DICHLOROPHENOL-1,8-3H-BENZO[DE]ISOCHROMEN-1-ONE	15044-97-0
1-Fluoro-4-((4-methylphenyl)sulphonyl)benzene	1643-97-6
Sulfone, bis(p-bromophenyl)	2050-48-8
Tetrahydro-magnolol	20601-85-8
Formaldehyde, polymer with 4,4'-(1-methylethylidene)bis(phenol)	25085-75-0
Phenol, 4-((4-aminophenyl)sulfonyl)-	25963-47-7
2,2'-(Sulphonylbis(4,1-phenyleneoxy))bisethanol	27205-03-4
Cyanic acid, C,C'-((2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)di-4,1-phenylene) ester	32728-27-1
Benzene, 1,1'-sulfonylbis(4-fluoro-	383-29-9
4,4'-Diiododiphenylsulfone	40915-22-8
Phenol, 4-(1-methyl-1-phenylethyl)-	599-64-4
Benzene, 1,1'-sulfonylbis(4-methyl-	599-66-6
4-cumylphenol	68443-32-3
Benzenamine, 4,4'-((2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis(4,1-phenyleneoxy))bis-	69563-88-8
4-((4-Iodophenyl)sulfonyl)phenol	7402-68-8
4-((4-Methylphenyl)sulfonyl)phenol	7402-77-9
Sulphenone	80-00-2
4,4'-Dichlorodiphenyl sulfone	80-07-9
Dapsone	80-08-0
Hexanoestrol	84-16-2
4,4'-BIPHENOL	92-88-6
Aniline, p-((p-butoxyphenyl)sulfonyl)-	not available
Phenol, 4-(phenylmethyl)-	101-53-1
Benzene, 1,1'-methylenebis-	101-81-5
4,4'-(2,2-Propanediyl)bis(2-isopropylphenol)	127-54-8
Phenol, 4,4'-(3,3,5-trimethylcyclohexylidene)bis-	129188-99-4

Appendix Table 1 (Continued)	
Chemical Name	**CASRN**
Phenol, 4,4'-[1,3-phenylenebis(1-methylethylidene)]bis-	13595-25-0
Phenol, 4,4'-(dichloroethenylidene)bis-	14868-03-2
4,4'-(Diphenylmethylene)diphenol	1844-01-5
Phenol, (1-methylethyl)-	25168-06-3
Bis(4-hydroxyphenyl)methanone	611-99-4
1,1'-(2,2-Propanediyl)dibenzene	778-22-3
1,1,1-Trichloro-2,2-bis(4-hydroxyphenyl)ehtane	2971-36-0

Appendix 2. Literature Search Strategy

For each of the 27 BPA analogues, SciFinder was searched using the analog's CASRN to retrieve synonym names as well as old or additional CASRNs. In addition, a broader search of the literature on bisphenol A analogues in general was done in order to retrieve articles that had not listed specific analogues in the title or abstract. Six databases were searched: Embase, PubMed, SciFinder, Scopus, Toxline and Web of Science. No publication year limits were imposed. The search strategy was customized for each database because of differences in syntax and is described in **Appendix Table 2**. For example, Embase does not recognize a square bracket; therefore, a chemical name such as 2-[(4-Hydroxyphenyl)sulfonyl]phenol needed to be converted to 2-((4-hydroxyphenol)sulfonyl)phenol.

The analogue specific searches for each database are found in **Appendix Table 3**. For some analogues, the abbreviations were often synonyms for other concepts and resulted in high results. In order to increase the relevancy of the results in these circumstances, an initial search was done just on the abbreviation. If even one relevant record was retrieved, then the abbreviation would be included in the search. Otherwise, the abbreviation was excluded. If an abbreviation was included and retrieved over 25 results, then the records were refined by subject area when possible in Scopus and Web of Science.

The original search for 27 BPA analogues was performed on March 24-28, 2014. A search update for the 24 BPA analogues followed in this protocol was performed on March 20-23, 2015. The search update did not include searches for the following three chemicals: PHBB, TBBPA, or TCBPA.

Appendix Table 2. Database specific literature search strategy				
Database (Host)	**Date Coverage**	**Search Strategy**	**Modifications**	**Notes**
Embase (Elsevier)	1947-Present	Used Advanced Search and checked 'map to preferred terminology,' 'search as free text', and 'include sub-terms/derivatives'	No apostrophe or square bracket (use parentheses instead)	CASRN not often indexed
Pubmed (National Library of Medicine (NLM))	1950-Present	Used Basic Search box	None	
SciFinder (Chemical Abstract Services (CAS))	1907-Present	Used CASRN to search by Substance Identifier. Opened chemical record and clicked on References. Limited results to: adverse effect, analytical, biological, miscellaneous, occurrence, properties and uses. Then refined by document type to exclude patents.	None	
Scopus (Elsevier)	1966-Present	Used Advanced Search	Refined search results to focus on biomedical-related effects based on subject areas listed under “notes”	• Ag/bio = agricultural and biological sciences • Biochem = biochemistry, genetics and molecular biology • Chem = chemistry • Enviro sci = environmental science • Immuno = immunology and microbiology • Medicine = medicine • Multi = multidisciplinary • Pharm = pharmacology, toxicology and therapeutics

Appendix Table 2 (continued)				
Database (Host)	**Date Coverage**	**Search Strategy**	**Modifications**	**Notes**
Toxline (National Library of Medicine (NLM))	Varies depending upon source	Used Basic Search box	No square brackets, CASRN enclosed in quotation marks	

Appendix Table 2 (continued)				
Database (Host)	**Date Coverage**	**Search Strategy**	**Modifications**	**Notes**
Web of Science (Thomson Reuters)	1950-Present	Used Advanced Search box	No CASRN field. Refined search results to focus on biomedical-related effects based on subject areas listed in "notes"	• allergy = allergy • biochem = biochemistry • molecular biology • biochem res = biochemical research methods • biotech = biotechnology • chem analyt = chemical analytical • derm = dermatology • endo = endocrinology metabolism • enviro sci = environmental sciences ecology • food sci = food science technology • multi=multidisciplinary • path = pathology • peoh = public environmental occupational health • pharm = pharmacology pharmacy • pvd = peripheral vascular disease • res exper = research experimental medicine • tox=toxicology • water = water

Appendix Table 3. Literature search strategies		
Search concept: Bisphenol analogs		
Database	**Records**	**Search Strategy**
Embase	619	Bisphenol* near/7 (analog* OR derivative* OR congener*)
Pubmed	338	Bisphenol*[tiab] AND (analog*[tiab] OR derivative*[tiab] OR congener*[tiab])
SciFinder	-	-
Scopus	428	TITLE(Bisphenol* w/7 (analog* OR derivative* OR congener*)) OR ABS(Bisphenol* w/7 (analog* OR derivative* OR congener*))
Toxline	72	bisphenol* AND (analog* OR derivative* OR congener*) *exclude* PubMed records
Web of Science	432	Bisphenol* near/7 (analog* OR derivative* OR congener*)
Chemical: 2,4-BPS **CASRN: 5397-34-2** **Synonyms:** Phenol, 2-[(4-hydroxyphenyl)sulfonyl]-; Phenol, 2,4'-sulfonyldi- ; 2,4'-Bisphenol sulfone; 2,4'-Dihydroxydiphenyl sulfone; 2,4'-Sulfonyldiphenol; 2-(4-Hydroxyphenylsulfonyl)phenol; 2-[(4-Hydroxyphenyl)sulfonyl]phenol; 24 Bisphenol S; 24BS; 2,4-BPS; 4,2'-Dihydroxydiphenyl sulfone		
Database	**Records**	**Search Strategy**
Embase	0	"2,4-bisphenol sulfone" OR "2,4-dihydroxydiphenyl sulfone" OR "o,p-dihydroxydiphenyl sulfone" OR "2,4 dihydroxydiphenylsulphone" OR "2,4-sulfonyldiphenol" OR "2,4-sulfonylbis(phenol)" OR "2-(4-hydrophenylsulfonyl)phenol" OR "2-(4-hydroxyphenyl)sulfonyl)phenol" OR "24 bisphenol s" OR "2,4-BPS" OR 24bs OR "4,2-dihydroxydiphenyl sulfone" OR "4,2-dihydroxydiphenylsulfone" OR 5397-34-2
Pubmed	0	"2,4-bisphenol sulfone"[tiab] OR "2,4-dihydroxydiphenyl sulfone"[tiab] OR "o,p-dihydroxydiphenyl sulfone"[tiab] OR "2,4 dihydroxydiphenylsulphone"[tiab] OR "2,4-sulfonyldiphenol"[tiab] OR "2,4-sulfonylbis(phenol)"[tiab] OR "2-(4-hydrophenylsulfonyl)phenol"[tiab] OR "2-[4-hydroxyphenyl)sulfonyl]phenol"[tiab] OR "24 bisphenol s"[tiab] OR "24bs"[tiab] OR "2,4-BPS"[tiab] OR "4,2-dihydroxydiphenyl sulfone"[tiab] OR "4,2-dihydroxydiphenylsulfone"[tiab] OR 5397-34-2[rn]
SciFinder	28/447	5397-34-2

Appendix Table 3. Literature search strategies		
Scopus	2	TITLE-ABS-KEY("2,4-bisphenol sulfone" OR "2,4-dihydroxydiphenyl sulfone" OR "o,p-dihydroxydiphenyl sulfone" OR "2,4 dihydroxydiphenylsulphone" OR "2,4-sulfonyldiphenol" OR "2,4-sulfonylbis(phenol)" OR "2-(4-hydrophenylsulfonyl)phenol" OR "2-[4-hydroxyphenyl)sulfonyl]phenol" OR "24 bisphenol s" OR "24bs" OR "2,4-BPS" OR "4,2-dihydroxydiphenyl sulfone" OR "4,2-dihydroxydiphenylsulfone") OR CASREGNUMBER(5397-34-2)
Toxline	3	"phenol 2 4 hydroxyphenyl sulfonyl" OR "2 4-bisphenol sulfone" OR "2 4-dihydroxydiphenyl sulfone" OR "o p-dihydroxydiphenyl sulfone" OR "2 4 dihydroxydiphenylsulphone" OR "2 4-sulfonyldiphenol" OR "2 4-sulfonylbis(phenol)" OR "2 4 hydrophenylsulfonyl phenol" OR "2 4 hydroxyphenyl sulfonyl phenol" OR "24 bisphenol s" OR "2 4-bps" OR "4 2-dihydroxydiphenyl sulfone" OR "4 2-dihydroxydiphenylsulfone" OR "5397-34-2" *NOTE: Excluded "24bs" - Toxline searched "24bs" as "24b," which denoted page numbers*
Web of Science	1	TS=("2,4-bisphenol sulfone" OR "2,4-dihydroxydiphenyl sulfone" OR "o,p-dihydroxydiphenyl sulfone" OR "2,4 dihydroxydiphenylsulphone" OR "2,4-sulfonyldiphenol" OR "2,4-sulfonylbis(phenol)" OR "2-(4-hydrophenylsulfonyl)phenol" OR "2-[(4-hydroxyphenyl)sulfonyl]phenol" OR "24 bisphenol s" OR "24bs" OR "2,4-BPS" OR "4,2-dihydroxydiphenyl sulfone" OR "4,2-dihydroxydiphenylsulfone")
Chemical: BPAF **CASRN: 1478-61-1; OLD: 110444-90-1; 1429425-28-4** **Synonyms:** Phenol, 4,4-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]bis-; 4,4-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]diphenol 4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol ; 1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane; 2,2-(4-Hydroxyphenyl)hexafluoropropane; 2,2-Bis(4-hydroxyphenyl) hexafluoropropane; 2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-hexafluoropropane; 2,2-Bis(4-hydroxyphenyl)hexafluoropropane; 2,2-Bis(4-hydroxyphenyl)perfluoropropane; 2,2-Bis(p-hydroxyphenyl)hexafluoropropane; 4,4-(Hexafluoroisopropylidene)bisphenol; 4,4-(Hexafluoroisopropylidene)diphenol; 4,4-hexafluorisopropylidene diphenol[nm]; 4,4-[2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol; Bisphenol AE; Biphenol AF; BIS-AF; BPAF; Hexafluorobisphenol A; Hexafluorodiphenylolpropane; Hexafluoroisopropylidenebis(4-hydroxybenzene)		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	64	"Phenol, 4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis" OR "4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)diphenol" OR "4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol" OR "1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane" OR "2,2-(4-Hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)perfluoropropane" OR "2,2-Bis(p-hydroxyphenyl)hexafluoropropane" OR "4,4-(Hexafluoroisopropylidene)bisphenol" OR "4,4-(Hexafluoroisopropylidene)diphenol" OR "4,4-[2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol" OR " Bisphenol AE" OR " Bisphenol AF" OR BIS-AF OR BPAF OR "Hexafluorobisphenol A" OR "Hexafluorodiphenylolpropane" OR "Hexafluoroisopropylidenebis(4-hydroxybenzene)" OR 1478-61-1:rn OR 110444-90-1:rn OR 1429425-28-4:rn
Pubmed	35	"Phenol, 4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis"[tiab] OR "4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)diphenol"[tiab] OR "4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol"[tiab] OR "1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane"[tiab] OR "2,2-(4-Hydroxyphenyl)hexafluoropropane"[tiab] OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane"[tiab] OR "2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-"[tiab] OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane"[tiab] OR "2,2-Bis(4-hydroxyphenyl)perfluoropropane"[tiab] OR "2,2-Bis(p-hydroxyphenyl)hexafluoropropane"[tiab] OR "4,4-(Hexafluoroisopropylidene) bisphenol"[tiab] OR "4,4-(Hexafluoroisopropylidene)diphenol"[tiab] OR "4,4-[2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol"[tiab] OR "Bisphenol AE"[tiab] OR "Bisphenol AF" OR BPAF OR "Hexafluorobisphenol A"[tiab] OR "Hexafluorodiphenylolpropane"[tiab] OR "Hexafluoroisopropylidenebis(4-hydroxybenzene)"[tiab] OR 1478-61-1[rn] OR 110444-90-1[rn] OR 1429425-28-4[rn] *NOTE: PubMed converts "bis-af" to searching 'BIS[all fields] and AF[all fields].' Removed term from search.*
SciFinder	146/1435	1478-61-1

Appendix Table 3. Literature search strategies		
Scopus	213	TITLE-ABS-KEY("Phenol, 4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis" OR "4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)diphenol" OR "4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol" OR "1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane" OR "2,2-(4-Hydroxyphenyl)hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)perfluoropropane" OR "2,2-Bis(p-hydroxyphenyl)hexafluoropropane" OR "4,4-(Hexafluoroisopropylidene)bisphenol" OR "4,4-(Hexafluoroisopropylidene)diphenol" OR "4,4-[2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol" OR "Bisphenol AE" OR "Bisphenol AF" OR "BIS-AF" OR BPAF OR "Hexafluorobisphenol A" OR "Hexafluorodiphenylolpropane" OR "Hexafluoroisopropylidenebis(4-hydroxybenzene)") OR CASREGNUMBER(1478-61-1)
Toxline	8	"Phenol, 4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis" OR "4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)diphenol" OR "4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol" OR "1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane" OR "2,2-(4-Hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)perfluoropropane" OR "2,2-Bis(p-hydroxyphenyl)hexafluoropropane" OR "4,4-(Hexafluoroisopropylidene)bisphenol" OR "4,4-(Hexafluoroisopropylidene)diphenol" OR "4,4-(2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol" OR "Bisphenol AE" OR "Bisphenol AF" OR "BIS-AF" OR BPAF OR "Hexafluorobisphenol A" OR "Hexafluorodiphenylolpropane" OR "Hexafluoroisopropylidenebis(4-hydroxybenzene)" OR "1478-61-1" OR "110444-90-1" OR "1429425-28-4"
Web of Science	232	TS=("Phenol, 4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)bis" OR "4,4-(2,2,2-trifluoro-1-(trifluoromethyl)ethylidene)diphenol" OR "4,4-(1,1,1,3,3,3-Hexafluoro-2,2-propanediyl)diphenol" OR "1,1,1,3,3,3-Hexafluoro-2,2-bis(4-hydroxyphenyl)propane" OR "2,2-(4-Hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)-1,1,1,3,3,3-" OR "2,2-Bis(4-hydroxyphenyl) hexafluoropropane" OR "2,2-Bis(4-hydroxyphenyl)perfluoropropane" OR "2,2-Bis(p-hydroxyphenyl)hexafluoropropane" OR "4,4-(Hexafluoroisopropylidene)bisphenol" OR "4,4-(Hexafluoroisopropylidene)diphenol" OR "4,4-[2,2,2-Trifluoro-1-(trifluoromethyl)ethylidene]bisphenol" OR "Bisphenol AE" OR "Bisphenol AF" OR "BIS-AF" OR BPAF OR "Hexafluorobisphenol A" OR "Hexafluorodiphenylolpropane" OR "Hexafluoroisopropylidenebis(4-hydroxybenzene)")
Chemical: BPAP	**CASRN: 1571-75-1**	

Appendix Table 3. Literature search strategies		
Synonyms: 4,4-(1-Phenyl-1,1-ethanediyl)diphenol; Phenol, 4,4-(1-phenylethylidene)bis-; Phenol, 4,4-(α-methylbenzylidene)di- (6CI,7CI, 8CI); 1,1-Bis(4-hydroxyphenyl)-1-phenylethane; 1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene)bisphenol; 4,4-(1-Phenylethylidene)diphenol; 4,4-(α-Methylbenzylidene)diphenol; Bis(4-hydroxyphenyl)methylphenylmethane; Bisp-Ap; Bisphenol ACP; Bisphenol AP; NK-AP; α,α-Bis(4-hydroxyphenyl)ethylbenzene		
Database	**Records**	**Search Strategy**
Embase	3	"4,4-(1-Phenyl-1,1-ethanediyl)diphenol" OR "Phenol, 4,4-(1-phenylethylidene)bis-" OR "Phenol, 4,4-(α-methylbenzylidene)di-" OR "1,1-Bis(4-hydroxyphenyl)-1-phenylethane" OR "1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene)bisphenol" OR "4,4-(1-Phenylethylidene) diphenol" OR "4,4-(α-Methylbenzylidene)diphenol" OR "4,4-(alpha-methylbenzylidene)diphenol" OR "Bis(4-hydroxyphenyl)methylphenylmethane" OR "Bisp-Ap" OR "Bisphenol ACP" OR "Bisphenol AP" OR "NK-AP" OR "α,α-Bis(4-hydroxyphenyl)ethylbenzene" OR "alpha, alpha-bis(4-hydroxyphenyl)ethylbenzene" OR 1571-75-1:rn
Pubmed	0	"4,4-(1-Phenyl-1,1-ethanediyl)diphenol"[tiab] OR "Phenol, 4,4-(1-phenylethylidene)bis-"[tiab] OR "Phenol, 4,4-(α-methylbenzylidene)di-"[tiab] OR "1,1-Bis(4-hydroxyphenyl)-1-phenylethane"[tiab] OR "1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene) bisphenol"[tiab] OR "4,4-(1-Phenylethylidene)diphenol"[tiab] OR "4,4-(α-Methylbenzylidene) diphenol"[tiab] OR "4,4-(alpha-methylbenzylidene)diphenol"[tiab] OR "Bis(4-hydroxyphenyl) methylphenylmethane"[tiab] OR "Bisp-Ap"[tiab] OR "Bisphenol ACP"[tiab] OR "Bisphenol AP"[tiab] OR "NK-AP"[tiab] OR "α,α-Bis(4-hydroxyphenyl)ethylbenzene"[tiab] OR "alpha, alpha-bis(4-hydroxyphenyl)ethylbenzene"[tiab] OR 1571-75-1[rn]
SciFinder	94/423	1571-75-1
Scopus	24	TITLE-ABS-KEY("4,4-(1-Phenyl-1,1-ethanediyl)diphenol" OR "Phenol, 4,4-(1-phenylethylidene)bis-" OR "Phenol, 4,4-(α-methylbenzylidene)di-" OR "1,1-Bis(4-hydroxyphenyl)-1-phenylethane" OR "1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene)bisphenol" OR "4,4-(1-Phenylethylidene)diphenol" OR "4,4-(α-Methylbenzylidene)diphenol" OR "4,4-(alpha-methylbenzylidene)diphenol" OR "Bis(4-hydroxyphenyl)methylphenylmethane" OR "Bisp-Ap" OR "Bisphenol ACP" OR "Bisphenol AP" OR "NK-AP" OR "α,α-Bis(4-hydroxyphenyl)ethylbenzene" OR "alpha, alpha-bis(4-hydroxyphenyl)ethylbenzene") OR CASREGNUMBER(1571-75-1)

Appendix Table 3. Literature search strategies		
Toxline	3	"4,4-(1-Phenyl-1,1-ethanediyl)diphenol" OR "Phenol, 4,4-(1-phenylethylidene)bis-" OR "Phenol, 4,4-(α-methylbenzylidene)di-" OR "1,1-Bis(4-hydroxyphenyl)-1-phenylethane" OR "1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene)bisphenol" OR "4,4-(1-Phenylethylidene) diphenol" OR "4,4-(α-Methylbenzylidene)diphenol" OR "4,4-(alpha-methylbenzylidene)diphenol" OR "Bis(4-hydroxyphenyl)methylphenylmethane" OR "Bisp-Ap" OR "Bisphenol ACP" OR "Bisphenol AP" OR "NK-AP" OR "α,α-Bis(4-hydroxyphenyl)ethylbenzene" OR "alpha, alpha-bis(4-hydroxyphenyl)ethylbenzene" OR "1571-75-1"
Web of Science	15	TS=("4,4-(1-Phenyl-1,1-ethanediyl)diphenol" OR "Phenol, 4,4-(1-phenylethylidene)bis-" OR "Phenol, 4,4-(α-methylbenzylidene)di-" OR "1,1-Bis(4-hydroxyphenyl)-1-phenylethane" OR "1-Phenyl-1,1-bis(4-hydroxyphenyl)ethane 4,4-(1-Phenylethylidene)bisphenol" OR "4,4-(1-Phenylethylidene)diphenol" OR "4,4-(α-Methylbenzylidene)diphenol" OR "4,4-(alpha-methylbenzylidene)diphenol" OR "Bis(4-hydroxyphenyl)methylphenylmethane" OR "Bisp-Ap" OR "Bisphenol ACP" OR "Bisphenol AP" OR "NK-AP" OR "α,α-Bis(4-hydroxyphenyl)ethylbenzene" OR "alpha, alpha-bis(4-hydroxyphenyl)ethylbenzene")
Chemical: BPB **CASRN: 77-40-7** **Synonyms:** Phenol, 4,4-(1-methylpropylidene)bis-; Phenol, 4,4-sec-butylidenedi- (6CI,7CI,8CI); 2,2-Bis(4-hydroxyphenyl)butane; 2,2-Bis(p-hydroxyphenyl)butane; 4,4-Dihydroxy-2,2-diphenylbutane; 4,4-sec-Butylidenediphenol Bis(4-hydroxyphenyl)ethylethylmethane; Bisphenol B[nm]; Butane, 2,2-bis(4-hydroxyphenyl)-; NSC 1775; p,p-Dihydroxy-2,2-diphenylbutane; p,p-sec-Butylidenediphenol		
Database	**Records**	**Search Strategy**
Embase	45	"Phenol, 4,4-(1-methylpropylidene)bis-" OR "Phenol, 4,4-sec-butylidenedi-" OR "2,2-Bis(4-hydroxyphenyl)butane" OR "2,2-Bis(p-hydroxyphenyl)butane" OR "4,4-Dihydroxy-2,2-diphenylbutane" OR "4,4-sec-Butylidenediphenol" OR "Bis(4-hydroxyphenyl)ethylethylmethane" OR "bisphenol b" OR "Butane, 2,2-bis(4-hydroxyphenyl)-" OR "NSC 1775" OR "p,p-Dihydroxy-2,2-diphenylbutane" OR "p,p-sec-Butylidenediphenol" OR 77-40-7:rn

Appendix Table 3. Literature search strategies		
Pubmed	36	"Phenol, 4,4-(1-methylpropylidene)bis-"[tiab] OR "Phenol, 4,4-sec-butylidenedi-"[tiab] OR "2,2-Bis(4-hydroxyphenyl)butane"[tiab] OR "2,2-Bis(p-hydroxyphenyl)butane"[tiab] OR "4,4-Dihydroxy-2,2-diphenylbutane"[tiab] OR "4,4-sec-Butylidenediphenol"[tiab] OR "Bis(4-hydroxyphenyl)ethylethylmethane"[tiab] OR "bisphenol b"[tiab] OR "bisphenol b"[nm] OR "Butane, 2,2-bis(4-hydroxyphenyl)-"[tiab] OR "NSC 1775"[tiab] OR "p,p-Dihydroxy-2,2-diphenylbutane"[tiab] OR 77-40-7[rn] *NOTE: PubMed converts "p,p-sec…" to searching 'p[all fields] and sec[all fields].' Term removed from search.*
SciFinder	180/395	77-40-7
Scopus	50	TITLE-ABS-Key("Phenol, 4,4-(1-methylpropylidene)bis-" OR "Phenol, 4,4-sec-butylidenedi-" OR "2,2-Bis(4-hydroxyphenyl)butane" OR "2,2-Bis(p-hydroxyphenyl)butane" OR "4,4-Dihydroxy-2,2-diphenylbutane" OR "4,4-sec-Butylidenediphenol" OR "Bis(4-hydroxyphenyl)ethylethylmethane" OR "bisphenol b" OR "Butane, 2,2-bis(4-hydroxyphenyl)-" OR "NSC 1775" OR "p,p-Dihydroxy-2,2-diphenylbutane" OR "p,p-sec-Butylidenediphenol") OR CASREGNUMBER(77-40-7)
Toxline	19	"Phenol, 4,4-(1-methylpropylidene)bis-" OR "Phenol, 4,4-sec-butylidenedi-" OR "2,2-Bis(4-hydroxyphenyl)butane" OR "2,2-Bis(p-hydroxyphenyl)butane" OR "4,4-Dihydroxy-2,2-diphenylbutane" OR "4,4-sec-Butylidenediphenol" OR "Bis(4-hydroxyphenyl)ethylethylmethane" OR "bisphenol b" OR "Butane, 2,2-bis(4-hydroxyphenyl)-" OR "NSC 1775" OR "p,p-Dihydroxy-2,2-diphenylbutane" OR "p,p-sec-Butylidenediphenol" OR "77-40-7"
Web of Science	34	TS=("Phenol, 4,4-(1-methylpropylidene)bis-" OR "Phenol, 4,4-sec-butylidenedi-" OR "2,2-Bis(4-hydroxyphenyl)butane" OR "2,2-Bis(p-hydroxyphenyl)butane" OR "4,4-Dihydroxy-2,2-diphenylbutane" OR "4,4-sec-Butylidenediphenol" OR "Bis(4-hydroxyphenyl)ethylethylmethane" OR "bisphenol b" OR "Butane, 2,2-bis(4-hydroxyphenyl)-" OR "NSC 1775" OR "p,p-Dihydroxy-2,2-diphenylbutane" OR "p,p-sec-Butylidenediphenol")
Chemical: BPC **CASRN: 79-97-0; OLD: 33935-87-4, 1195181-97-5** **Synonyms:** Phenol, 4,4-(1-methylethylidene)bis[2-methyl-; o-Cresol, 4,4-isopropylidenedi- (7CI,8CI); 2,2-Bis(3-methyl-4-hydroxyphenyl) propane; 2,2-Bis(4-hydroxy-3-methylphenyl)propane; 2,2-(4-Hydroxy-3-methylphenyl)propane; 2,2-Dimethyl-4,4-isopropylidenebisphenol; 3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane; 3,3-Dimethylbisphenol A; 3,3-Dimethyldian; 4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane; 4,4-Isopropylidenebis[2-methylphenol]; 4,4-Isopropylidenedi-o-cresol; Bis-o-cresol A; Bisphenol C; Dicresylolpropane; NSC 408489; Nonox DCP		

Appendix Table 3. Literature search strategies		
Database	**Records**	**Search Strategy**
Embase	14	"Phenol, 4,4-(1-methylethylidene)bis (2-methyl-" OR "o-Cresol, 4,4-isopropylidenedi-" OR "2,2-Bis(3-methyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-methylphenyl)propane" OR "2,2-(4-Hydroxy-3-methylphenyl)propane" OR "2,2-Dimethyl-4,4-isopropylidenebisphenol" OR "3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "3,3-Dimethylbisphenol A" OR "3,3-Dimethyldian" OR "4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane" OR "4,4-Isopropylidenebis(2-methylphenol)" OR "4,4-Isopropylidenedi-o-cresol" OR "Bis-o-cresol A" OR "Bisphenol C" OR "Dicresylolpropane" OR "NSC 408489" OR "Nonox DCP" OR 79-97-0:rn OR 33935-87-4:rn OR 1195181-97-5:rn
Pubmed	3	"Phenol, 4,4-(1-methylethylidene)bis[2-methyl-"[tiab] OR "o-Cresol, 4,4-isopropylidenedi-"[tiab] OR "2,2-Bis(3-methyl-4-hydroxyphenyl)propane"[tiab] OR "2,2-Bis(4-hydroxy-3-methylphenyl) propane"[tiab] OR "2,2-(4-Hydroxy-3-methylphenyl)propane"[tiab] OR "2,2-Dimethyl-4,4-isopropylidenebisphenol"[tiab] OR "3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane"[tiab] OR "3,3-Dimethylbisphenol A"[tiab] OR "3,3-Dimethyldian"[tiab] OR "4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane"[tiab] OR "4,4-Isopropylidenebis[2-methylphenol]"[tiab] OR "4,4-Isopropylidenedi-o-cresol"[tiab] OR "Bis-o-cresol A"[tiab] OR "Bisphenol C"[tiab] OR "Dicresylolpropane"[tiab] OR "NSC 408489"[tiab] OR "Nonox DCP" OR 79-97-0[rn] OR 33935-87-4[rn] OR 1195181-97-5[rn]
SciFinder	164/513	79-97-0
Scopus	16/104	TITLE-ABS-KEY("Phenol, 4,4-(1-methylethylidene)bis (2-methyl-" OR "o-Cresol, 4,4-isopropylidenedi-" OR "2,2-Bis(3-methyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-methylphenyl)propane" OR "2,2-(4-Hydroxy-3-methylphenyl)propane" OR "2,2-Dimethyl-4,4-isopropylidenebisphenol" OR "3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "3,3-Dimethylbisphenol A" OR "3,3-Dimethyldian" OR "4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane" OR "4,4-Isopropylidenebis(2-methylphenol)" OR "4,4-Isopropylidenedi-o-cresol" OR "Bis-o-cresol A" OR "Bisphenol C" OR "Dicresylolpropane" OR "NSC 408489" OR "Nonox DCP") OR CASREGNUMBER(79-97-0 OR 33935-87-4 OR 1195181-97-5) *Subject areas included*: biochem, enviro sci, pharm, ag/bio, immuno, multi

Appendix Table 3. Literature search strategies		
Toxline	6	"Phenol, 4,4-(1-methylethylidene)bis (2-methyl-" OR "o-Cresol, 4,4-isopropylidenedi-" OR "2,2-Bis(3-methyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-methylphenyl)propane" OR "2,2-(4-Hydroxy-3-methylphenyl)propane" OR "2,2-Dimethyl-4,4-isopropylidenebisphenol" OR "3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "3,3-Dimethylbisphenol A" OR "3,3-Dimethyldian" OR "4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane" OR "4,4-Isopropylidenebis(2-methylphenol)" OR "4,4-Isopropylidenedi-o-cresol" OR "Bis-o-cresol A" OR "Bisphenol C" OR "Dicresylolpropane" OR "NSC 408489" OR "Nonox DCP" OR "79-97-0" OR "33935-87-4" OR "1195181-97-5"
Web of Science	9/86	TS=("Phenol, 4,4-(1-methylethylidene)bis (2-methyl-" OR "o-Cresol, 4,4-isopropylidenedi-" OR "2,2-Bis(3-methyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-methylphenyl)propane" OR "2,2-(4-Hydroxy-3-methylphenyl)propane" OR "2,2-Dimethyl-4,4-isopropylidenebisphenol" OR "3,3-Dimethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "3,3-Dimethylbisphenol A" OR "3,3-Dimethyldian" OR "4,4-Dihydroxy-3,3-dimethyldiphenyl-2,2-propane" OR "4,4-Isopropylidenebis(2-methylphenol)" OR "4,4-Isopropylidenedi-o-cresol" OR "Bis-o-cresol A" OR "Bisphenol C" OR "Dicresylolpropane" OR "NSC 408489" OR "Nonox DCP") *Categories refined by*: biotech, enviro sci, pharm, tox, biochem, chem analyt, food sci, res exper, multi
Chemical: BPE **CASRN: 2081-08-5** **Synonyms:** Phenol, 4,4-ethylidenebis-; Phenol, 4,4-ethylidenedi- ; 1,1-Bis(4-hydroxyphenyl)ethane ; 4,4-(1,1-Ethanediyl)diphenol ; 4,4-Ethylidenebisphenol; 4,4-Ethylidenediphenol; Bisphenol AD; Bisphenol E		
Database	**Records**	**Search Strategy**
Embase	18	"Phenol, 4,4-ethylidenebis-" OR "Phenol, 4,4-ethylidenedi-" OR "1,1-Bis(4-hydroxyphenyl)ethane" OR "4,4-(1,1-Ethanediyl)diphenol" OR "4,4-Ethylidenebisphenol" OR "4,4-Ethylidenediphenol" OR "Bisphenol AD" OR "Bisphenol E" OR 2081-08-5:rn
Pubmed	18	"Phenol, 4,4-ethylidenebis-"[tiab] OR "Phenol, 4,4-ethylidenedi-"[tiab] OR "1,1-Bis(4-hydroxyphenyl)ethane"[tiab] OR "4,4-(1,1-Ethanediyl)diphenol"[tiab] OR "4,4-Ethylidenebisphenol"[tiab] OR "4,4-Ethylidenediphenol"[tiab] OR "Bisphenol AD"[tiab] OR "Bisphenol E"[tiab] OR 2081-08-5[rn]
SciFinder	152/424	2081-08-5

Appendix Table 3. Literature search strategies		
Scopus	16/78	TITLE-ABS-KEY("Phenol, 4,4-ethylidenebis-" OR "Phenol, 4,4-ethylidenedi-" OR "1,1-Bis(4-hydroxyphenyl)ethane" OR "4,4-(1,1-Ethanediyl)diphenol" OR "4,4-Ethylidenebisphenol" OR "4,4-Ethylidenediphenol" OR "Bisphenol AD" OR "Bisphenol E") OR CASREGNUMBER(2081-08-5) *Subject areas included*: Enviro sci, pharm, biochem, agri/bio, immuno
Toxline	6	"Phenol, 4,4-ethylidenebis-" OR "Phenol, 4,4-ethylidenedi-" OR "1,1-Bis(4-hydroxyphenyl)ethane" OR "4,4-(1,1-Ethanediyl)diphenol" OR "4,4-Ethylidenebisphenol" OR "4,4-Ethylidenediphenol" OR "Bisphenol AD" OR "Bisphenol E" OR "2081-08-5"
Web of Science	17/60	TS=("Phenol, 4,4-ethylidenebis-" OR "Phenol, 4,4-ethylidenedi-" OR "1,1-Bis(4-hydroxyphenyl) ethane" OR "4,4-(1,1-Ethanediyl)diphenol" OR "4,4-Ethylidenebisphenol" OR "4,4-Ethylidenediphenol" OR "Bisphenol AD" OR "Bisphenol E") *Categories refined by*: Chem analyt, multi, enviro sci, food sci, tox, allergy, biochem, biotech, derm, pvd, water
Chemical: 2,2-BPF **CASRN: 2467-02-9** **Synonyms:** Phenol, 2,2-methylenebis-; Phenol, 2,2-methylenedi- (7CI,8CI); 2,2-Bis(hydroxyphenyl)methane; 2,2-Dihydroxydiphenylmethane OR 2,2-dihydroxydiphenyl methane; 2,2-Methylenebis[phenol]; 2,2-Methylenediphenol; Bis(2-hydroxyphenyl)methane ; Bisphenol F; NSC 402103; o,o-Bis(hydroxyphenyl)methane; o-(o-Hydroxybenzyl)phenol		
Database	**Records**	**Search Strategy**
Embase	166	"Phenol, 2,2-methylenebis-" OR "Phenol, 2,2-methylenedi-" OR "2,2-Bis(hydroxyphenyl) methane" OR "2,2-Dihydroxydiphenylmethane" OR "2,2-dihydroxydiphenyl methane" OR "2,2-Methylenebis(phenol)" OR "2,2-Methylenediphenol" OR "Bis(2-hydroxyphenyl)methane" OR "Bisphenol F" OR "NSC 402103" OR "o,o-Bis(hydroxyphenyl)methane" OR "o-(o-Hydroxybenzyl) phenol" OR 2467-02-9:rn
Pubmed	118	"Phenol, 2,2-methylenebis-"[tiab] OR "Phenol, 2,2-methylenedi-"[tiab] OR "2,2-Bis(hydroxyphenyl)methane"[tiab] OR "2,2-Dihydroxydiphenylmethane"[tiab] OR "2,2-dihydroxydiphenyl methane"[tiab] OR "2,2-Methylenebis(phenol)"[tiab] OR "2,2-Methylenediphenol"[tiab] OR "Bis(2-hydroxyphenyl)methane"[tiab] OR "Bisphenol F"[tiab] OR "NSC 402103"[tiab] OR "o,o-Bis(hydroxyphenyl)methane"[tiab] OR "o-(o-Hydroxybenzyl) phenol"[tiab] OR 2467-02-9[rn]

Appendix Table 3. Literature search strategies		
SciFinder	125/491	2467-02-9
Scopus	149/398	TITLE-ABS-KEY("Phenol, 2,2-methylenebis-" OR "Phenol, 2,2-methylenedi-" OR "2,2-Bis(hydroxyphenyl)methane" OR "2,2-Dihydroxydiphenylmethane" OR "2,2-dihydroxydiphenyl methane" OR "2,2-Methylenebis[phenol]" OR "2,2-Methylenediphenol" OR "Bis(2-hydroxyphenyl)methane" OR "Bisphenol F" OR "NSC 402103" OR "o,o-Bis(hydroxyphenyl) methane" OR "o-(o-Hydroxybenzyl)phenol") OR CASREGNUMBER(2467-02-9) *Subject areas included*: enviro science, pharm, biochem, medicine, ag/bio, immuno
Toxline	90	"Phenol, 2,2-methylenebis-" OR "Phenol, 2,2-methylenedi-" OR "2,2-Bis(hydroxyphenyl) methane" OR "2,2-Dihydroxydiphenylmethane" OR "2,2-dihydroxydiphenyl methane" OR "2,2-Methylenebis(phenol)" OR "2,2-Methylenediphenol" OR "Bis(2-hydroxyphenyl)methane" OR "Bisphenol F" OR "NSC 402103" OR "o,o-Bis(hydroxyphenyl)methane" OR "o-(o-Hydroxybenzyl) phenol" OR "2467-02-9"
Web of Science	132/318	TS=("Phenol, 2,2-methylenebis-" OR "Phenol, 2,2-methylenedi-" OR "2,2-Bis(hydroxyphenyl) methane" OR "2,2-Dihydroxydiphenylmethane" OR "2,2-dihydroxydiphenyl methane" OR "2,2-Methylenebis(phenol)" OR "2,2-Methylenediphenol" OR "Bis(2-hydroxyphenyl)methane" OR "Bisphenol F" OR "NSC 402103" OR "o,o-Bis(hydroxyphenyl)methane" OR "o-(o-Hydroxybenzyl) phenol") *Categories refined by*: Tox, food sci, chem multi, biochem res, enviro sci, derm, allergy, chem med, pharm, biochem, water, ag, poh, microbio, bio, endo, gene, medicine, nutri, multi, pvd, repro bio
Chemical: 4,4-BPF	**CASRN: 620-92-8 OLD: 1429425-30-8**	
Synonyms: Phenol, 4,4-methylenebis-; Phenol, 4,4-methylenedi- (8CI); Phenol, p,p-methylenedi- (4CI); 1,1-Bis(4-hydroxyphenyl) methane; 4,4-Bis(hydroxyphenyl)methane; 4,4-Dihydroxydiphenylmethane; 4,4-Methylenebis[phenol]; 4,4-Methylenediphenol; Bis(4-hydroxyphenyl)methane; Bis(p-hydroxyphenyl)methane; Bisphenol F *[not included in search due to analog included above]*; HDM *[not included, abbreviation stands for too many other irrelevant concepts]*; NSC 401136; PP-BIP-F; p,p-BPF; p-(p-Hydroxybenzyl)phenol		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	34	"Phenol, 4,4-methylenebis-" OR "Phenol, 4,4-methylenedi-" OR "Phenol, p,p-methylenedi-" OR "1,1-Bis(4-hydroxyphenyl)methane" OR "4,4-Bis(hydroxyphenyl)methane" OR "4,4-Dihydroxydiphenylmethane" OR "4,4-Methylenebis(phenol)" OR "4,4-Methylenediphenol" OR "Bis(4-hydroxyphenyl)methane" OR "Bis(p-hydroxyphenyl)methane" OR "NSC 401136" OR "PP-BIP-F" OR "p,p-BPF" OR "p-(p-Hydroxybenzyl)phenol" OR 620-92-8:rn OR 1429425-30-8:rn
Pubmed	15	"Phenol, 4,4-methylenebis-"[tiab] OR "Phenol, 4,4-methylenedi-"[tiab] OR "Phenol, p,p-methylenedi-"[tiab] OR "1,1-Bis(4-hydroxyphenyl)methane"[tiab] OR "4,4-Bis(hydroxyphenyl) methane"[tiab] OR "4,4-Dihydroxydiphenylmethane"[tiab] OR "4,4-Methylenebis[phenol]"[tiab] OR "4,4-Methylenediphenol"[tiab] OR "Bis(4-hydroxyphenyl)methane"[tiab] OR "Bis(p-hydroxyphenyl)methane"[tiab] OR "NSC 401136"[tiab] OR "PP-BIP-F"[tiab] OR "p,p-BPF"[tiab] OR "p-(p-Hydroxybenzyl)phenol"[tiab] OR "4,4'-bisphenol F"[nm] OR 620-92-8[rn] OR 1429425-30-8[rn]
SciFinder	328/1254	620-92-8
Scopus	40/55	TITLE-ABS-KEY("Phenol, 4,4-methylenebis-" OR "Phenol, 4,4-methylenedi-" OR "Phenol, p,p-methylenedi-" OR "1,1-Bis(4-hydroxyphenyl)methane" OR "4,4-Bis(hydroxyphenyl)methane" OR "4,4-Dihydroxydiphenylmethane" OR "4,4-Methylenebis[phenol]" OR "4,4-Methylenediphenol" OR "Bis(4-hydroxyphenyl)methane" OR "Bis(p-hydroxyphenyl)methane" OR "NSC 401136" OR "PP-BIP-F" OR "p,p-BPF" OR "p-(p-Hydroxybenzyl)phenol") OR CASREGNUMBER(620-92-8 OR 1429425-30-8) *Subject areas included*: pharm, enviro sci, biochem, med, immuno, ag/bio,
Toxline	13	"Phenol, 4,4-methylenebis-" OR "Phenol, 4,4-methylenedi-" OR "Phenol, p,p-methylenedi-" OR "1,1-Bis(4-hydroxyphenyl)methane" OR "4,4-Bis(hydroxyphenyl)methane" OR "4,4-Dihydroxydiphenylmethane" OR "4,4-Methylenebis(phenol)" OR "4,4-Methylenediphenol" OR "Bis(4-hydroxyphenyl)methane" OR "Bis(p-hydroxyphenyl)methane" OR "NSC 401136" OR "PP-BIP-F" OR "p,p-BPF" OR "p-(p-Hydroxybenzyl)phenol" OR "620-92-8" OR "1429425-30-8"

Appendix Table 3. Literature search strategies		
Web of Science	24/42	TS=("Phenol, 4,4-methylenebis-" OR "Phenol, 4,4-methylenedi-" OR "Phenol, p,p-methylenedi-" OR "1,1-Bis(4-hydroxyphenyl)methane" OR "4,4-Bis(hydroxyphenyl)methane" OR "4,4-Dihydroxydiphenylmethane" OR "4,4-Methylenebis[phenol]" OR "4,4-Methylenediphenol" OR "Bis(4-hydroxyphenyl)methane" OR "Bis(p-hydroxyphenyl)methane" OR "NSC 401136" OR "PP-BIP-F" OR "p,p-BPF" OR "p-(p-Hydroxybenzyl)phenol") *Categories refined by*: enviro sci, chem multi, chem med, pharm, biochem, tox, biotech, food sci, bio, chem analyt, immuno, microbio, water
Chemical: BPP **CASRN: 2167-51-3** **Synonyms:** Phenol, 4,4-[1,4-phenylenebis(1-methylethylidene)]bis-; 4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol; Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI,8CI); 1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene; 1,4-Bis(4-hydroxycumyl)benzene; 1,4-Bis(p-hydroxycumyl)benzene; 1,4-Bis[2-(4-hydroxyphenyl)-2-propyl]benzene; 1,4-Bis[α-methyl-α-(4-hydroxyphenyl)ethyl]benzene; 4,4-(p-Phenylenediisopropylidene)bisphenol; 4,4-(p-Phenylenediisopropylidene)diphenol; B 1563; Bisphenol P; α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene; α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene		
Database	**Records**	**Search Strategy**
Embase	6	"Phenol, 4,4-(1,4-phenylenebis(1-methylethylidene))bis-" OR "4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol" OR "Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI,8CI)" OR "1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene" OR "1,4-Bis(4-hydroxycumyl)benzene" OR "1,4-Bis(p-hydroxycumyl)benzene" OR "1,4-Bis(2-(4-hydroxyphenyl)-2-propyl)benzene" OR "1,4-Bis(α-methyl-α-(4-hydroxyphenyl)ethyl)benzene" OR "4,4-(p-Phenylenediisopropylidene)bisphenol" OR "4,4-(p-Phenylenediisopropylidene)diphenol" OR "B 1563" OR "Bisphenol P" OR "α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene" OR "α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene" OR 2167-51-3:rn
Pubmed	5	"Phenol, 4,4-(1,4-phenylenebis(1-methylethylidene))bis-"[tiab] OR "4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol"[tiab] OR "Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI,8CI)"[tiab] OR "1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene"[tiab] OR "1,4-Bis(4-hydroxycumyl) benzene"[tiab] OR "1,4-Bis(p-hydroxycumyl)benzene"[tiab] OR "1,4-Bis(2-(4-hydroxyphenyl)-2-propyl)benzene"[tiab] OR "1,4-Bis(α-methyl-α-(4-hydroxyphenyl)ethyl)benzene"[tiab] OR "4,4-(p-Phenylenediisopropylidene)bisphenol"[tiab] OR "4,4-(p-Phenylenediisopropylidene) diphenol"[tiab] OR "B 1563"[tiab] OR "Bisphenol P"[tiab] OR "α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene"[tiab] OR "α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene"[tiab] OR 2167-51-3[rn]

Appendix Table 3. Literature search strategies		
SciFinder	26/287	2167-51-3
Scopus	8/27	TITLE-ABS-KEY("Phenol, 4,4-[1,4-phenylenebis(1-methylethylidene)]bis-" OR "4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol" OR "Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI, 8CI)" OR "1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene" OR "1,4-Bis(4-hydroxycumyl) benzene" OR "1,4-Bis(p-hydroxycumyl)benzene" OR "1,4-Bis[2-(4-hydroxyphenyl)-2-propyl] benzene" OR "1,4-Bis[α-methyl-α-(4-hydroxyphenyl)ethyl]benzene" OR "4,4-(p-Phenylenediisopropylidene)bisphenol" OR "4,4-(p-Phenylenediisopropylidene)diphenol" OR "B 1563" OR "Bisphenol P" OR "α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene" OR "α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene") OR CASREGNUMBER(2167-51-3) *Subject areas included*: biochem, enviro sci, pharm, agri/bio,
Toxline	16	"Phenol, 4,4-[1,4-phenylenebis(1-methylethylidene)]bis-" OR "4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol" OR "Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI,8CI)" OR "1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene" OR "1,4-Bis(4-hydroxycumyl)benzene" OR "1,4-Bis(p-hydroxycumyl)benzene" OR "1,4-Bis[2-(4-hydroxyphenyl)-2-propyl]benzene" OR "1,4-Bis[α-methyl-α-(4-hydroxyphenyl)ethyl]benzene" OR "4,4-(p-Phenylenediisopropylidene)bisphenol" OR "4,4-(p-Phenylenediisopropylidene)diphenol" OR "B 1563" OR "Bisphenol P" OR "α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene" OR "α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene" OR "2167-51-3" *NOTE: Most are incorrect interpretations of the search. Toxline searched "bisphenol p" as "bisphenol" near "p"*
Web of Science	7/26	TS=("Phenol, 4,4-[1,4-phenylenebis(1-methylethylidene)]bis-" OR "4,4-(1,4-Phenylenedi-2,2-propanediyl)diphenol" OR "Phenol, 4,4-(p-phenylenediisopropylidene)di- (7CI,8CI)" OR "1,4-Bis(1-(4-hydroxyphenyl)-1-methylethyl)benzene" OR "1,4-Bis(4-hydroxycumyl)benzene" OR "1,4-Bis(p-hydroxycumyl)benzene" OR "1,4-Bis[2-(4-hydroxyphenyl)-2-propyl]benzene" OR "1,4-Bis[α-methyl-α-(4-hydroxyphenyl)ethyl]benzene" OR "4,4-(p-Phenylenediisopropylidene)bisphenol" OR "4,4-(p-Phenylenediisopropylidene)diphenol" OR "B 1563" OR "Bisphenol P" OR "α,α-Bis(4-hydroxyphenyl)-1,4-diisopropylbenzene" OR "α,α-Bis(4-hydroxyphenyl)-p-diisopropylbenzene") *Categories refined by*: chem multi, enviro sci, ag multi, chem analyt, eng enviro, food sci, tox, water

Appendix Table 3. Literature search strategies		
Chemical: BPPH **CASRN: 24038-68-4** **Synonyms:** [1,1-Biphenyl]-2-ol, 5,5-(1-methylethylidene)bis-; 2-Biphenylol, 5,5-isopropylidenedi- (8CI); 2,2-Bis(3-phenyl-4-hydroxyphenyl)propane; 2,2-Bis(4-hydroxy-3-phenylphenyl)propane; 5,5-(1-Methylethylidene)bis[1,1-biphenyl]-2-ol; 5,5-(2,2-Propanediyl)di(2-biphenylol); Bis-OPPA; BisOPP-A; Bisphenol PH		
Database	**Records**	**Search Strategy**
Embase	0	"(1,1-Biphenyl)-2-ol, 5,5-(1-methylethylidene)bis-" OR "2-Biphenylol, 5,5-isopropylidenedi-" OR "2,2-Bis(3-phenyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-phenylphenyl)propane" OR "5,5-(1-Methylethylidene)bis(1,1-biphenyl)-2-ol" OR "5,5-(2,2-Propanediyl)di(2-biphenylol)" OR "bis-OPPA" OR "BisOPP-A" OR "Bisphenol PH" OR 24038-68-4:rn
Pubmed	0	"[1,1-Biphenyl]-2-ol, 5,5-(1-methylethylidene)bis-"[tiab] OR "2-Biphenylol, 5,5-isopropylidenedi-"[tiab] OR "2,2-Bis(3-phenyl-4-hydroxyphenyl)propane"[tiab] OR "2,2-Bis(4-hydroxy-3-phenylphenyl)propane"[tiab] OR "5,5-(1-Methylethylidene)bis[1,1-biphenyl]-2-ol"[tiab] OR "5,5-(2,2-Propanediyl)di(2-biphenylol)"[tiab] OR "bis-OPPA" [tiab] OR "BisOPP-A"[tiab] OR "Bisphenol PH"[tiab] OR 24038-68-4[rn]
SciFinder	5/74	24038-68-4
Scopus	1	TITLE-ABS-KEY("[1,1-Biphenyl]-2-ol, 5,5-(1-methylethylidene)bis-" OR "2-Biphenylol, 5,5-isopropylidenedi-" OR "2,2-Bis(3-phenyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-phenylphenyl)propane" OR "5,5-(1-Methylethylidene)bis[1,1-biphenyl]-2-ol" OR "5,5-(2,2-Propanediyl)di(2-biphenylol)" OR "bis-OPPA" OR "BisOPP-A" OR "Bisphenol PH") OR CASREGNUMBER(24038-68-4)
Toxline	0/2	"(1,1-Biphenyl(-2-ol, 5,5-(1-methylethylidene)bis-" OR "2-Biphenylol, 5,5-isopropylidenedi-" OR "2,2-Bis(3-phenyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-phenylphenyl)propane" OR "5,5-(1-Methylethylidene)bis(1,1-biphenyl)-2-ol" OR "5,5-(2,2-Propanediyl)di(2-biphenylol)" OR "bis-OPPA" OR "BisOPP-A" OR "Bisphenol PH" OR "24038-68-4" *[neither were relevant – retrieved 'Bisphenol A (PH)']*
Web of Science	0	TS=("[1,1-Biphenyl]-2-ol, 5,5-(1-methylethylidene)bis-" OR "2-Biphenylol, 5,5-isopropylidenedi-" OR "2,2-Bis(3-phenyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3-phenylphenyl) propane" OR "5,5-(1-Methylethylidene)bis[1,1-biphenyl]-2-ol" OR "5,5-(2,2-Propanediyl)di(2-biphenylol)" OR "bis-OPPA" OR "BisOPP-A" OR "Bisphenol PH")
Chemical: BPS	**CASRN:** 80-09-1; OLD: 98388-00-2, 280144-23-2	

Appendix Table 3. Literature search strategies		
Synonyms: Phenol, 4,4-sulfonylbis-; Phenol, 4,4-sulfonyldi- (6CI,8CI); 1,1-Sulfonylbis[4-hydroxybenzene]; 4,4-Bisphenol S; 4,4-Dihydroxydiphenyl sulfone; 4,4-Sulfonylbis[phenol]; 4,4-Sulfonyldiphenol; 4-(4-Hydroxyphenylsulfonyl)phenol; 4-Hydroxyphenyl sulfone; BPS 1; BPS-H; BPS-N; BPS-P; BS 3; BS 3 (phenol); BS-PN; Bis(4-hydroxyphenyl)sulfone[nm]; Bis(p-hydroxyphenyl) sulfone; Bisphenol S; D 8 [*also own separate analog entry*]; Diphone A; Diphone C; Diphone D; Dynamar FC 5166; Ex 1B; NSC 683541; NSC 8712; p,p-Dihydroxydiphenyl sulfone. *NOTE: excluded "bps 1", "bps-n", "bps-p", "bs 3", and "d 8" – retrieves from 750 to over 3000 irrelevant results depending upon database*		
Database	**Records**	**Search Strategy**
Embase	71	"Phenol, 4,4-sulfonylbis-" OR "Phenol, 4,4-sulfonyldi-" OR "1,1-Sulfonylbis(4-hydroxybenzene)" OR "4,4-Bisphenol S" OR "4,4-Dihydroxydiphenyl sulfone" OR "4,4-Sulfonylbis(phenol)" OR "4,4-Sulfonyldiphenol" OR "4-(4-Hydroxyphenylsulfonyl)phenol" OR "4-Hydroxyphenyl sulfone" OR "BPS 1" OR "BPS-H" OR "BPS-N" OR "BPS-P" OR "BS 3" OR "BS 3 (phenol)" OR "BS-PN" OR "Bis(p-hydroxyphenyl) sulfone" OR "Bisphenol S" OR "D 8" OR "Diphone A" OR "Diphone C" OR "Diphone D" OR "Dynamar FC 5166" OR "Ex 1B" OR "NSC 683541" OR "NSC 8712" OR "p,p-Dihydroxydiphenyl sulfone" OR "80-09-1":rn OR "98388-00-2":rn OR "280144-23-2":rn
Pubmed	60	"Phenol, 4,4-sulfonylbis-"[tiab] OR "Phenol, 4,4-sulfonyldi-"[tiab] OR "1,1-Sulfonylbis[4-hydroxybenzene]"[tiab] OR "4,4-Bisphenol S"[tiab] OR "4,4-Dihydroxydiphenyl sulfone"[tiab] OR "4,4-Sulfonylbis[phenol]"[tiab] OR "4,4-Sulfonyldiphenol"[tiab] OR "4-(4-Hydroxyphenylsulfonyl) phenol"[tiab] OR "4-Hydroxyphenyl sulfone"[tiab] OR "BPS 1"[tiab] OR "BPS-H"[tiab] OR "BPS-N"[tiab] OR "BPS-P"[tiab] OR "BS 3"[tiab] OR "BS 3 (phenol)"[tiab] OR "BS-PN"[tiab] OR "Bis(p-hydroxyphenyl) sulfone"[tiab] OR "Bisphenol S"[tiab] OR "D 8"[tiab] OR "Diphone A"[tiab] OR "Diphone C"[tiab] OR "Diphone D"[tiab] OR "Dynamar FC 5166"[tiab] OR "Ex 1B"[tiab] OR "NSC 683541"[tiab] OR "NSC 8712"[tiab] OR "p,p-Dihydroxydiphenyl sulfone"[tiab] OR "80-09-1"[rn] OR "98388-00-2"[rn] OR "280144-23-2"[rn] OR "Bis(4-hydroxyphenyl)sulfone"[nm]
SciFinder	306/2512	80-09-1

Appendix Table 3. Literature search strategies		
Scopus	64/258	TITLE-ABS-KEY("Phenol, 4,4-sulfonylbis-" OR "Phenol, 4,4-sulfonyldi-" OR "1,1-Sulfonylbis[4-hydroxybenzene]" OR "4,4-Bisphenol S" OR "4,4-Dihydroxydiphenyl sulfone" OR "4,4-Sulfonylbis[phenol]" OR "4,4-Sulfonyldiphenol" OR "4-(4-Hydroxyphenylsulfonyl)phenol" OR "4-Hydroxyphenyl sulfone" OR "BPS 1" OR "BPS-H" OR "BPS-N" OR "BPS-P" OR "BS 3" OR "BS 3 (phenol)" OR "BS-PN" OR "Bis(p-hydroxyphenyl) sulfone" OR "Bisphenol S" OR "D 8" OR "Diphone A" OR "Diphone C" OR "Diphone D" OR "Dynamar FC 5166" OR "Ex 1B" OR "NSC 683541" OR "NSC 8712" OR "p,p-Dihydroxydiphenyl sulfone") OR CASREGNUMBER("80-09-1" OR "98388-00-2" OR "280144-23-2") *Subject areas included*: enviro sci, biochem, pharm, medicine, ag/bio, immuno, multi
Toxline	33	"Phenol 4 4 sulfonylbis" OR "Phenol 4 4 sulfonyldi" OR "1 1 Sulfonylbis 4 hydroxybenzene" OR "4 4 Bisphenol S" OR "4 4 Dihydroxydiphenyl sulfone" OR "4 4Sulfonylbis phenol" OR "4 4 Sulfonyldiphenol" OR "4 4 Hydroxyphenylsulfonyl phenol" OR "4 Hydroxyphenyl sulfone" OR "BS 3 phenol" OR "BS PN" OR "Bis p hydroxyphenyl sulfone" OR "Bisphenol S" OR "Diphone A" OR "Diphone C" OR "Diphone D" OR "Dynamar FC 5166" OR "Ex 1B" OR "NSC 683541" OR "NSC 8712" OR "Dihydroxydiphenyl sulfone" OR "80-09-1" OR "98388-00-2" OR "280144-23-2"
Web of Science	49/289	TS=("Phenol, 4,4-sulfonylbis-" OR "Phenol, 4,4-sulfonyldi-" OR "1,1-Sulfonylbis[4-hydroxybenzene]" OR "4,4-Bisphenol S" OR "4,4-Dihydroxydiphenyl sulfone" OR "4,4-Sulfonylbis[phenol]" OR "4,4-Sulfonyldiphenol" OR "4-(4-Hydroxyphenylsulfonyl)phenol" OR "4-Hydroxyphenyl sulfone" OR "BPS 1" OR "BPS-H" OR "BPS-N" OR "BPS-P" OR "BS 3" OR "BS 3 (phenol)" OR "BS-PN" OR "Bis(p-hydroxyphenyl) sulfone" OR "Bisphenol S" OR "D 8" OR "Diphone A" OR "Diphone C" OR "Diphone D" OR "Dynamar FC 5166" OR "Ex 1B" OR "NSC 683541" OR "NSC 8712" OR "p,p-Dihydroxydiphenyl sulfone") *Categories refined by*: Enviro sci, chem analyt, tox, biochem res, peoh, pharm, food sci, biochem, biotech, zoo, marine, ag multi
Chemical: BPZ	**CASRN**: 843-55-0; OLD: 66138-64-5, 70903-43-4, 317803-63-7	
Synonyms: Phenol, 4,4-cyclohexylidenebis-; Phenol, 4,4-cyclohexylidenedi- (6CI,8CI); 1,1-bis(4-hydroxyphenyl)cyclohexane[nm]; 1,1-bis(p-Hydroxyphenyl)cyclohexane; 4,4-(1,1-Cyclohexanediyl)diphenol; 4,4-Cyclohexylidenebisphenol; 4,4-Cyclohexylidenediphenol; Antigene W; Bis-Z; Bisphenol Z; BPCH; Dian C; NSC 29881; NSC 50761		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	21	"Phenol, 4,4-cyclohexylidenebis-" OR "Phenol, 4,4-cyclohexylidenedi-" OR "1,1-bis(p-Hydroxyphenyl)cyclohexane" OR "4,4-(1,1-Cyclohexanediyl)diphenol" OR "4,4-Cyclohexylidenebisphenol" OR "4,4-Cyclohexylidenediphenol" OR "Antigene W" OR "Bisphenol Z" OR "BPCH" OR (BPZ AND bisphenol) OR "Dian C":ti,ab OR "NSC 29881" OR "NSC 50761" OR 843-55-0:rn OR 66138-64-5:rn OR 70903-43-4:rn OR 317803-63-7:rn *NOTE: removed "Bis-Z" - retrieved either German "A bis Z" or other chemical names that included "Bis[(Z"*
Pubmed	16	"Phenol, 4,4-cyclohexylidenebis-"[tiab] OR "Phenol, 4,4-cyclohexylidenedi-"[tiab] OR "1,1-bis(4-hydroxyphenyl)cyclohexane[nm]"[tiab] OR "1,1-bis(p-Hydroxyphenyl)cyclohexane"[tiab] OR "4,4-(1,1-Cyclohexanediyl)diphenol"[tiab] OR "4,4-Cyclohexylidenebisphenol"[tiab] OR "4,4-Cyclohexylidenediphenol"[tiab] OR "Antigene W"[tiab] OR "Bis-Z"[tiab] OR "Bisphenol Z"[tiab] OR "BPCH"[tiab] OR (BPZ[tiab] AND bisphenol[tiab]) OR "Dian C"[tiab] OR "NSC 29881"[tiab] OR "NSC 50761" OR 843-55-0[rn] OR 66138-64-5[rn] OR 70903-43-4[rn] OR 317803-63-7[rn]
SciFinder	73/962	843-55-0
Scopus	13/81	TITLE-ABS-KEY("Phenol, 4,4-cyclohexylidenebis-" OR "Phenol, 4,4-cyclohexylidenedi-" OR "1,1-bis(p-Hydroxyphenyl)cyclohexane" OR "4,4-(1,1-Cyclohexanediyl)diphenol" OR "4,4-Cyclohexylidenebisphenol" OR "4,4-Cyclohexylidenediphenol" OR "Antigene W" OR "Bisphenol Z" OR "BPCH" OR (BPZ AND bisphenol) OR "Dian C" OR "NSC 29881" OR "NSC 50761") OR CASREGNUMBER(843-55-0 OR 66138-64-5 OR 70903-43-4 OR 317803-63-7) *Subject areas included*: medicine, biochem, pharm, enviro sci *NOTE: removed "Bis-Z" – retrieved either German "A bis Z" or other chemical names that included "Bis[(Z"*
Toxline	15	"Phenol 4,4-cyclohexylidenebis-" OR "Phenol, 4,4-cyclohexylidenedi-" OR "1,1-bis(p-Hydroxyphenyl)cyclohexane" OR "4,4-(1,1-Cyclohexanediyl)diphenol" OR "4,4-Cyclohexylidenebisphenol" OR "4,4-Cyclohexylidenediphenol" OR "Antigene W" OR "Bis-Z" OR "Bisphenol Z" OR "BPCH" OR (BPZ AND bisphenol) OR "Dian C" OR "NSC 29881" OR "NSC 50761" OR "843-55-0" OR "66138-64-5" OR "70903-43-4" OR "317803-63-7"

Appendix Table 3. Literature search strategies		
Web of Science	37/123	TS=("Phenol, 4,4-cyclohexylidenebis-" OR "Phenol, 4,4-cyclohexylidenedi-" OR "1,1-bis(p-Hydroxyphenyl)cyclohexane" OR "4,4-(1,1-Cyclohexanediyl)diphenol" OR "4,4-Cyclohexylidenebisphenol" OR "4,4-Cyclohexylidenediphenol" OR "Antigene W" OR "Bis-Z" OR "Bisphenol Z" OR BPCH OR (BPZ AND bisphenol) OR "Dian C" OR "NSC 29881" OR "NSC 50761") = *Categories refined by*: chem multi, tox, chem analyt, biochem res, biochem, chem med, enviro sci, pharm, peoh
Chemical: BDP	**CASRN:** 5945-33-5; OLD: 68816-50-2, 251939-97-6, 477883-52-6, 1192033-45-6, 1207356-86-2	
Synonyms: BPA bis(diphenyl phosphate); Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester; Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester (9CI); Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol (7CI); Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester (8CI); 2,2-Bis[4-[bis(phenoxy)phosphoryloxy]phenyl]propane; 4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate); ADK Stab FP 600; ADK Stab FP 700; BADP; BDP; BPA-DP; Bisphenol A bis(diphenyl phosphate); Bisphenol A tetraphenyl diphosphate; CG 963; CR 7415; CR 741S; CR 742; E 890; FP 600; FP 700; FP 750; Fyrolflex BDP; NcendX P 30; Tetraphenyl bisphenol A bisphosphate; WSFR-BDP; WSFR-BDP-N 2		
Database	**Records**	**Search Strategy**
Embase	7	"BPA bis(diphenylphosphate)" OR "BPA bis(diphenyl phosphate)" OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, (1-methylethylidene) di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol " OR "Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester " OR "2,2-Bis(4-(bis(phenoxy)phosphoryloxy)phenyl)propane" OR "4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate)" OR "ADK Stab FP 600" OR "ADK Stab FP 700" OR (BADP AND bisphenol) OR ("BDP" AND bisphenol) OR "BPA-DP" OR "Bisphenol A bis(diphenylphosphate)" OR "bisphenol A diphenyl phosphate" OR "Bisphenol A bis(diphenyl phosphate)" OR "Bisphenol A tetraphenyl diphosphate" OR "CG 963" OR "CR 7415" OR "CR 741S" OR "CR 742" OR "E 890" OR "Fyrolflex BDP" OR "NcendX P 30" OR "Tetraphenyl bisphenol A bisphosphate" OR "WSFR-BDP" OR "WSFR-BDP-N 2" OR 5945-33-5:rn OR 68816-50-2:rn OR 251939-97-6:rn OR 477883-52-6:rn OR 1192033-45-6:rn OR 1207356-86-2:rn *NOTE: removed "FP n" - retrieved irrelevant fluticasone propionate results*

Appendix Table 3. Literature search strategies		
Pubmed	5	"BPA bis(diphenylphosphate)"[tiab] OR "BPA bis(diphenyl phosphate)"[tiab] "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester"[tiab] OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester"[tiab] OR "Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol "[tiab] OR "Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester "[tiab] OR "2,2-Bis(4-(bis(phenoxy)phosphoryloxy)phenyl) propane"[tiab] OR "4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate)"[tiab] OR "ADK Stab FP 600"[tiab] OR "ADK Stab FP 700"[tiab] OR (BADP[tiab] AND bisphenol[tiab]) OR (BDP[tiab] AND bisphenol[tiab]) OR "BPA-DP"[tiab] OR "Bisphenol A bis(diphenylphosphate)"[tiab] OR "bisphenol A diphenyl phosphate"[tiab] OR "Bisphenol A bis(diphenyl phosphate)"[tiab] OR "Bisphenol A tetraphenyl diphosphate"[tiab] OR "CG 963"[tiab] OR "CR 7415"[tiab] OR "CR 741S"[tiab] OR "CR 742"[tiab] OR "E 890"[tiab] OR "FP 600"[tiab] OR "FP 700"[tiab] OR "FP 750"[tiab] OR "Fyrolflex BDP"[tiab] OR "NcendX P 30"[tiab] OR "Tetraphenyl bisphenol A bisphosphate"[tiab] OR "WSFR-BDP"[tiab] OR "WSFR-BDP-N 2"[tiab] OR 5945-33-5[rn] OR 68816-50-2[rn] OR 251939-97-6[rn] OR 477883-52-6[rn] OR 1192033-45-6[rn] OR 1207356-86-2[rn]
SciFinder	97/947	5945-33-5
Scopus	23/56	TITLE-ABS-KEY("BPA bis(diphenylphosphate)" OR "BPA bis(diphenyl phosphate)" OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol " OR "Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester " OR "2,2-Bis[4-[bis(phenoxy)phosphoryloxy]phenyl]propane" OR "4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate)" OR "ADK Stab FP 600" OR "ADK Stab FP 700" OR (BADP AND bisphenol) OR (BDP AND bisphenol) OR "BPA-DP" OR "bisphenol A diphenyl phosphate" OR "Bisphenol A bis(diphenylphosphate)" OR "Bisphenol A bis(diphenyl phosphate)" OR "Bisphenol A tetraphenyl diphosphate" OR "CG 963" OR "CR 7415" OR "CR 741S" OR "CR 742" OR "E 890" OR "FP 600" OR "FP 700" OR "FP 750" OR "Fyrolflex BDP" OR "NcendX P 30" OR "Tetraphenyl bisphenol A bisphosphate" OR "WSFR-BDP" OR "WSFR-BDP-N 2") OR CASREGNUMBER(5945-33-5 OR 68816-50-2 OR 251939-97-6 OR 477883-52-6 OR 1192033-45-6 OR 1207356-86-2) *Subject areas included*: chem, envirosci, biochem, health, med

Appendix Table 3. Literature search strategies		
Toxline	3	"BPA bis(diphenylphosphate)" OR "BPA bis(diphenyl phosphate)" OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, (1-methylethylidene) di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol " OR "Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester " OR "2,2-Bis(4-((bis(phenoxy)phosphoryloxy)phenyl)propane" OR "4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate)" OR "ADK Stab FP 600" OR "ADK Stab FP 700" OR (BADP AND bisphenol) OR (BDP AND bisphenol) OR "BPA-DP" OR "bisphenol A diphenyl phosphate" OR "Bisphenol A bis(diphenylphosphate)" OR "Bisphenol A bis(diphenyl phosphate)" OR "Bisphenol A tetraphenyl diphosphate" OR "CG 963" OR "CR 7415" OR "CR 741S" OR "CR 742" OR "E 890" OR "Fyrolflex BDP" OR "NcendX P 30" OR "Tetraphenyl bisphenol A bisphosphate" OR "WSFR-BDP" OR "WSFR-BDP-N 2" OR "5945-33-5" OR "68816-50-2" OR "251939-97-6" OR "477883-52-6" OR "1192033-45-6" OR "1207356-86-2" *NOTE: removed "FP n" - retrieved irrelevant fluticasone propionate results*
Web of Science	11/47	TS=("BPA bis(diphenylphosphate)" OR "BPA bis(diphenyl phosphate)" OR "Phosphoric acid, (1-methylethylidene)di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, (1-methylethylidene) di-4,1-phenylene tetraphenyl ester" OR "Phosphoric acid, diphenyl ester, diester with 4,4-isopropylidenediphenol " OR "Phosphoric acid, isopropylidenedi-p-phenylene tetraphenyl ester " OR "2,2-Bis[4-[bis(phenoxy)phosphoryloxy]phenyl]propane" OR "4,4-(Isopropylidenediphenyl) bis(diphenyl phosphate)" OR "ADK Stab FP 600" OR "ADK Stab FP 700" OR (BADP AND bisphenol) OR (BDP AND bisphenol) OR "BPA-DP" OR "bisphenol A diphenyl phosphate" OR "Bisphenol A bis(diphenylphosphate)" OR "Bisphenol A bis(diphenyl phosphate)" OR "Bisphenol A tetraphenyl diphosphate" OR "CG 963" OR "CR 7415" OR "CR 741S" OR "CR 742" OR "E 890" OR "FP 600" OR "FP 700" OR "FP 750" OR "Fyrolflex BDP" OR "NcendX P 30" OR "Tetraphenyl bisphenol A bisphosphate" OR "WSFR-BDP" OR "WSFR-BDP-N 2") *Categories refined by*: chem analyt, pharm, enviro sci, biochem res, allergy, cardiac, immuno
Chemical: BPS-MAE CASRN: 97042-18-7; OLD: 1033893-40-1 **Synonyms:** Phenol, 4-[[4-(2-propen-1-yloxy)phenyl]sulfonyl]-; Phenol, 4-[[4-(2-propenyloxy)phenyl]sulfonyl]- (9CI); 4-Allyloxy-4-hydroxydiphenylsulfone; 4-Hydroxy-4-allyloxy diphenyl sulfone; 4-Allyloxyphenylsulfonyl-4-phenol; 4-([4-(Allyloxy)phenyl]sulfonyl)phenol; BIS-MAE; BPS-MAE; Bis(4-hydroxyphenyl)sulfone monoallyl ether		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	0	"Phenol, 4-((4-(2-propen-1-yloxy)phenyl)sulfonyl)-" OR "Phenol, 4-((4-(2-propenyloxy)phenyl) sulfonyl)" OR "4-Allyloxy-4-hydroxydiphenylsulfone" OR "4-Hydroxy-4-allyloxy diphenyl sulfone" OR "4-Allyloxyphenylsulfonyl-4-phenol" OR "4-((4-(Allyloxy)phenyl)sulfonyl)phenol" OR "BIS-MAE" OR "BPS-MAE" OR "Bis(4-hydroxyphenyl)sulfone monoallyl ether" OR 97042-18-7:rn OR 1033893-40-1:rn
Pubmed	0	"Phenol, 4-((4-(2-propen-1-yloxy)phenyl)sulfonyl)-"[tiab] OR "Phenol, 4-((4-(2-propenyloxy) phenyl)sulfonyl)"[tiab] OR "4-Allyloxy-4-hydroxydiphenylsulfone"[tiab] OR "4-Hydroxy-4-allyloxy diphenyl sulfone"[tiab] OR "4-Allyloxyphenylsulfonyl-4-phenol"[tiab] OR "4-((4-(Allyloxy)phenyl)sulfonyl)phenol"[tiab] OR "BIS-MAE"[tiab] OR "BPS-MAE"[tiab] OR "Bis(4-hydroxyphenyl)sulfone monoallyl ether"[tiab] OR 97042-18-7[rn] OR 1033893-40-1[rn]
SciFinder	1/106	97042-18-7
Scopus	0	TITLE-ABS-KEY("Phenol, 4-[[4-(2-propen-1-yloxy)phenyl]sulfonyl]-" OR "Phenol, 4-[[4-(2-propenyloxy)phenyl]sulfonyl]" OR "4-Allyloxy-4-hydroxydiphenylsulfone" OR "4-Hydroxy-4-allyloxy diphenyl sulfone" OR "4-Allyloxyphenylsulfonyl-4-phenol" OR "4-{[4-(Allyloxy)phenyl]sulfonyl}phenol" OR "BIS-MAE" OR "BPS-MAE" OR "Bis(4-hydroxyphenyl)sulfone monoallyl ether") OR CASREGNUMBER(97042-18-7 OR 1033893-40-1)
Toxline	0	"Phenol, 4-((4-(2-propen-1-yloxy)phenyl)sulfonyl)-" OR "Phenol, 4-((4-(2-propenyloxy) phenyl)sulfonyl)" OR "4-Allyloxy-4-hydroxydiphenylsulfone" OR "4-Hydroxy-4-allyloxy diphenyl sulfone" OR "4-Allyloxyphenylsulfonyl-4-phenol" OR "4-((4-(Allyloxy)phenyl)sulfonyl)phenol" OR "BIS-MAE" OR "BPS-MAE" OR "Bis(4-hydroxyphenyl)sulfone monoallyl ether" OR "97042-18-7" OR "1033893-40-1"
Web of Science	0	TS=("Phenol, 4-[[4-(2-propen-1-yloxy)phenyl]sulfonyl]-" OR "Phenol, 4-[[4-(2-propenyloxy) phenyl]sulfonyl]" OR "4-Allyloxy-4-hydroxydiphenylsulfone" OR "4-Hydroxy-4-allyloxy diphenyl sulfone" OR "4-Allyloxyphenylsulfonyl-4-phenol" OR "4-{[4-(Allyloxy)phenyl]sulfonyl}phenol" OR "BIS-MAE" OR "BPS-MAE" OR "Bis(4-hydroxyphenyl)sulfone monoallyl ether")
Chemical: BPS-MPE **CASRN: 63134-33-8** **Synonyms:** Phenol, 4-[[4-(phenylmethoxy)phenyl]sulfonyl]-; 4-Benzyloxy-4-hydroxydiphenyl sulfone; 4-Benzyloxyphenyl 4-hydroxyphenyl sulfone; 4-Benzyloxyphenyl-4-hydroxyphenyl sulfone; 4-Hydroxy-4-benzyloxydiphenyl sulfone; BPS-BN; BPS-MPE; p-(p-Benzyloxyphenylsulfonyl)phenol		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	0	"Phenol, 4-((4-(phenylmethoxy)phenyl)sulfonyl)-" OR "4-Benzyloxy-4-hydroxydiphenyl sulfone" OR "4-Benzyloxyphenyl 4-hydroxyphenyl sulfone" OR "4-Benzyloxyphenyl-4-hydroxyphenyl sulfone" OR "4-Hydroxy-4-benzyloxydiphenyl sulfone" OR "BPS-BN" OR "BPS-MPE" OR "p-(p-Benzyloxyphenylsulfonyl)phenol" OR 63134-33-8:rn
Pubmed	0	"Phenol, 4-((4-(phenylmethoxy)phenyl)sulfonyl)-"[tiab] OR "4-Benzyloxy-4-hydroxydiphenyl sulfone"[tiab] OR "4-Benzyloxyphenyl 4-hydroxyphenyl sulfone"[tiab] OR "4-Benzyloxyphenyl-4-hydroxyphenyl sulfone"[tiab] OR "4-Hydroxy-4-benzyloxydiphenyl sulfone"[tiab] OR "BPS-BN"[tiab] OR "BPS-MPE"[tiab] OR "p-(p-Benzyloxyphenylsulfonyl)phenol"[tiab] OR 63134-33-8[rn]
SciFinder	2/137	63134-33-8
Scopus	0	TITLE-ABS-KEY("Phenol, 4-[[4-(phenylmethoxy)phenyl]sulfonyl]-" OR "4-Benzyloxy-4-hydroxydiphenyl sulfone" OR "4-Benzyloxyphenyl 4-hydroxyphenyl sulfone" OR "4-Benzyloxyphenyl-4-hydroxyphenyl sulfone" OR "4-Hydroxy-4-benzyloxydiphenyl sulfone" OR "BPS-BN" OR "BPS-MPE" OR "p-(p-Benzyloxyphenylsulfonyl)phenol") OR CASREGNUMBER(63134-33-8)
Toxline	1	"Phenol, 4-((4-(phenylmethoxy)phenyl)sulfonyl)-" OR "4-Benzyloxy-4-hydroxydiphenyl sulfone" OR "4-Benzyloxyphenyl 4-hydroxyphenyl sulfone" OR "4-Benzyloxyphenyl-4-hydroxyphenyl sulfone" OR "4-Hydroxy-4-benzyloxydiphenyl sulfone" OR "BPS-BN" OR "BPS-MPE" OR "p-(p-Benzyloxyphenylsulfonyl)phenol" OR "63134-33-8"
Web of Science	0	TS=("Phenol, 4-[[4-(phenylmethoxy)phenyl]sulfonyl]-" OR "4-Benzyloxy-4-hydroxydiphenyl sulfone" OR "4-Benzyloxyphenyl 4-hydroxyphenyl sulfone" OR "4-Benzyloxyphenyl-4-hydroxyphenyl sulfone" OR "4-Hydroxy-4-benzyloxydiphenyl sulfone" OR "BPS-BN" OR "BPS-MPE" OR "p-(p-Benzyloxyphenylsulfonyl)phenol")
Chemical: BTUM	**CASRN: 151882-81-4; OLD: 161090-27-3**	
Synonyms: Benzenesulfonamide, N,N-[methylenebis(4,1-phenyleneiminocarbonyl)]bis[4-methyl-; 4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane; 4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane; 4,4-Bis(p-toluenesulfonylaminocarboxylamino)diphenylmethane ; 4,4-Bis(p-tolylsulfonylureido)diphenylmethane; BTUM		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	0	"Benzenesulfonamide, N,N-(methylenebis(4,1-phenyleneiminocarbonyl))bis(4-methyl-" OR "4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane " OR "4,4-Bis(p-toluenesulfonylamino carboxylamino)diphenylmethane " OR "4,4-Bis(p-tolylsulfonylureido)diphenylmethane" OR "BTUM" OR 151882-81-4:rn OR 161090-27-3:rn
Pubmed	0	"Benzenesulfonamide, N,N-(methylenebis(4,1-phenyleneiminocarbonyl))bis(4-methyl-"[tiab] OR "4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane"[tiab] OR "4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane "[tiab] OR "4,4-Bis(p-toluenesulfonylaminocarboxylamino)diphenylmethane"[tiab] OR "4,4-Bis(p-tolylsulfonylureido) diphenylmethane"[tiab] OR "BTUM"[tiab] OR 151882-81-4[rn] OR 161090-27-3[rn]
SciFinder	2/144	151882-81-4
Scopus	0	TITLE-ABS-KEY("Benzenesulfonamide, N,N-[methylenebis(4,1-phenyleneiminocarbonyl)]bis[4-methyl-" OR "4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylamino carboxylamino)diphenylmethane" OR "4,4-Bis(p-tolylsulfonylureido)diphenylmethane" OR "BTUM") OR CASREGNUMBER(151882-81-4 OR 161090-27-3)
Toxline	0	"Benzenesulfonamide, N,N-(methylenebis(4,1-phenyleneiminocarbonyl)]bis(4-methyl-" OR "4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylamino carboxylamino)diphenylmethane" OR "4,4-Bis(p-tolylsulfonylureido)diphenylmethane" OR "BTUM" OR "151882-81-4" OR "161090-27-3"
Web of Science	0	TS=("Benzenesulfonamide, N,N-[methylenebis(4,1-phenyleneiminocarbonyl)]bis[4-methyl-" OR "4,4-bis(N-carbamoyl-4-methylbenzenesulfomide)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylaminocarbonylamino)diphenylmethane" OR "4,4-Bis(p-toluenesulfonylamino carboxylamino)diphenylmethane" OR "4,4-Bis(p-tolylsulfonylureido)diphenylmethane" OR "BTUM")
Chemical: D-8 **CASRN: 95235-30-6; OLD: 106607-88-9** **Synonyms:** Phenol, 4-[[4-(1-methylethoxy)phenyl]sulfonyl]-; *4-[(4-Isopropoxyphenyl)sulfonyl]phenol;* 4-Hydroxy-4-isopropoxy phenyl sulfone; 4-Hydroxy-4-isopropoxydiphenyl sulfone; 4-Hydroxyphenyl 4-isopropoxyphenyl sulfone; 4-Isopropoxy-4-hydroxydiphenyl sulfone; D 8 OR D8; F 647; NYDS ; *NOTE: excluded F647 and NYDS – retrieved irrelevant results*		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	9	"Phenol, 4-((4-(1-methylethoxy)phenyl)sulfonyl)-" OR "4-((4-Isopropoxyphenyl)sulfonyl)phenol" OR "4-Hydroxy-4-isopropoxy phenyl sulfone" OR "4-Hydroxy-4-isopropoxydiphenyl sulfone" OR "4-Hydroxyphenyl 4-isopropoxyphenyl sulfone" OR "4-Isopropoxy-4-hydroxydiphenyl sulfone" OR (("D 8" OR D8) AND bisphenol) OR 95235-30-6:rn OR 106607-88-9:rn
Pubmed	5	"Phenol, 4-[[4-(1-methylethoxy)phenyl]sulfonyl]-"[tiab] OR "4-[(4-Isopropoxyphenyl)sulfonyl]phenol"[tiab] OR "4-Hydroxy-4-isopropoxy phenyl sulfone"[tiab] OR "4-Hydroxy-4-isopropoxydiphenyl sulfone"[tiab] OR "4-Hydroxyphenyl 4-isopropoxyphenyl sulfone"[tiab] OR "4-Isopropoxy-4-hydroxydiphenyl sulfone"[tiab] OR (("D 8"[tiab] OR D8[tiab]) AND bisphenol[tiab]) OR 95235-30-6[rn] OR 106607-88-9[rn]
SciFinder	18/852	95235-30-6
Scopus	17	TITLE-ABS-KEY("Phenol, 4-[[4-(1-methylethoxy)phenyl]sulfonyl]-" OR "4-[(4-Isopropoxyphenyl)sulfonyl]phenol" OR "4-Hydroxy-4-isopropoxy phenyl sulfone" OR "4-Hydroxy-4-isopropoxydiphenyl sulfone" OR "4-Hydroxyphenyl 4-isopropoxyphenyl sulfone" OR "4-Isopropoxy-4-hydroxydiphenyl sulfone" OR (("D 8" OR D8) AND bisphenol)) OR CASREGNUMBER(95235-30-6 OR 106607-88-9)
Toxline	5	"Phenol, 4-((4-(1-methylethoxy)phenyl)sulfonyl)-" OR "4-((4-Isopropoxyphenyl)sulfonyl)phenol" OR "4-Hydroxy-4-isopropoxy phenyl sulfone" OR "4-Hydroxy-4-isopropoxydiphenyl sulfone" OR "4-Hydroxyphenyl 4-isopropoxyphenyl sulfone" OR "4-Isopropoxy-4-hydroxydiphenyl sulfone" OR (("D 8" OR D8) AND bisphenol) OR "95235-30-6" OR "106607-88-9"
Web of Science	11	TS=("Phenol, 4-[[4-(1-methylethoxy)phenyl]sulfonyl]-" OR "4-[(4-Isopropoxyphenyl)sulfonyl]phenol" OR "4-Hydroxy-4-isopropoxy phenyl sulfone" OR "4-Hydroxy-4-isopropoxydiphenyl sulfone" OR "4-Hydroxyphenyl 4-isopropoxyphenyl sulfone" OR "4-Isopropoxy-4-hydroxydiphenyl sulfone" OR (("D 8" OR D8) AND bisphenol))
Chemical: D-90	**CASRN: 191680-83-8**	
Synonyms: Ethane, 1,1'-oxybis[2-chloro-, polymer with 4,4'-sulfonylbis[phenol] (9CI); 4,4'-Dihydroxydiphenyl sulfone- 2,2'-Dichlorodiethyl ether copolymer; 4,4'-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer; Bis(2-chloroethyl)ether-4,4'-dihydroxydiphenyl sulfone copolymer		
Database	**Records**	**Search Strategy**
Embase	0	"Ethane, 1,1-oxybis(2-chloro-, polymer with 4,4-sulfonylbis(phenol)" OR "4,4-Dihydroxydiphenyl sulfone-2,2-Dichlorodiethyl ether copolymer" OR "4,4-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer" OR "Bis(2-chloroethyl)ether-4,4-dihydroxydiphenyl sulfone copolymer" OR ((D90 OR "D 90") AND bisphenol) OR 191680-83-8:rn

Appendix Table 3. Literature search strategies		
Pubmed	0	"Ethane, 1,1'-oxybis[2-chloro-, polymer with 4,4'-sulfonylbis[phenol]"[tiab] OR "4,4'-Dihydroxydiphenyl sulfone-2,2'-Dichlorodiethyl ether copolymer"[tiab] OR "4,4'-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer"[tiab] OR "Bis(2-chloroethyl) ether-4,4'-dihydroxydiphenyl sulfone copolymer"[tiab] OR ((D90[tiab] OR "D 90"[tiab]) AND bisphenol) OR 191680-83-8[rn]
SciFinder	0/19	191680-83-8 *[all 19 were patents]*
Scopus	0/1	TITLE-ABS-KEY("Ethane, 1,1'-oxybis[2-chloro-, polymer with 4,4'-sulfonylbis[phenol]" OR "4,4'-Dihydroxydiphenyl sulfone-2,2'-Dichlorodiethyl ether copolymer" OR "4,4'-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer" OR "Bis(2-chloroethyl)ether-4,4'-dihydroxydiphenyl sulfone copolymer" OR ((D90 OR "D 90") AND bisphenol)) OR CASREGNUMBER(191680-83-8) *[retrieved same as Web of Science result]*
Toxline	0	Ethane, 1,1'-oxybis(2-chloro-), polymer with 4,4'-sulfonylbis(phenol)" OR "4,4'-Dihydroxydiphenyl sulfone-2,2'-Dichlorodiethyl ether copolymer" OR "4,4'-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer" OR "Bis(2-chloroethyl)ether-4,4'-dihydroxydiphenyl sulfone copolymer" OR ((D90 OR "D 90") AND bisphenol) OR "191680-83-8"
Web of Science	0/1	TS=("Ethane, 1,1'-oxybis[2-chloro-, polymer with 4,4'-sulfonylbis[phenol]" OR "4,4'-Dihydroxydiphenyl sulfone-2,2'-Dichlorodiethyl ether copolymer" OR "4,4'-Dihydroxydiphenyl sulfone-bis(2-chloroethyl) ether copolymer" OR "Bis(2-chloroethyl)ether-4,4'-dihydroxydiphenyl sulfone copolymer" OR ((D90 OR "D 90") AND bisphenol)) *[not relevant –polymer nanocomposites]*
Chemical: DD-70 **CASRN: 93589-69-6** **Synonyms:** Phenol, 4,4-[methylenebis(oxy-2,1-ethanediylthio)]bis-; 4,4-[Methylenebis(oxy-2,1-ethanediylsulfanediyl)]diphenol; 1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane; Bis[2-(4-hydroxyphenylthio)ethoxy]methane ; DD70; DD 70		
Database	**Records**	**Search Strategy**
Embase	0	"Phenol, 4,4-(methylenebis(oxy-2,1-ethanediylthio))bis-" OR "4,4-(Methylenebis(oxy-2,1-ethanediylsulfanediyl))diphenol" OR "1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane" OR "Bis(2-(4-hydroxyphenylthio)ethoxy)methane" OR ((DD70 OR "DD 70") AND bisphenol) OR 93589-69-6:rn

Appendix Table 3. Literature search strategies		
Pubmed	0	"Phenol, 4,4-[methylenebis(oxy-2,1-ethanediylthio)]bis-"[tiab] OR "4,4-[Methylenebis(oxy-2,1-ethanediylsulfanediyl)]diphenol"[tiab] OR "1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane"[tiab] OR "Bis[2-(4-hydroxyphenylthio)ethoxy]methane"[tiab] OR ((DD70[tiab] OR "DD 70"[tiab]) AND bisphenol) OR 93589-69-6[rn]
SciFinder	3/125	93589-69-6
Scopus	=0/1	TITLE-ABS-KEY("Phenol, 4,4-[methylenebis(oxy-2,1-ethanediylthio)]bis-" OR "4,4-[Methylenebis(oxy-2,1-ethanediylsulfanediyl)]diphenol" *OR* "1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane" OR "Bis[2-(4-hydroxyphenylthio)ethoxy]methane " OR ((DD70 OR "DD 70") AND bisphenol)) OR CASREGNUMBER(93589-69-6) *[retrieved same as Web of Science result]*
Toxline	0	"Phenol, 4,4-(methylenebis(oxy-2,1-ethanediylthio))bis-" OR "4,4-(Methylenebis(oxy-2,1-ethanediylsulfanediyl))diphenol" OR "1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane" OR "Bis(2-(4-hydroxyphenylthio)ethoxy)methane" OR ((DD70 OR "DD 70") AND bisphenol) OR "93589-69-6"
Web of Science	1	TS=("Phenol, 4,4-[methylenebis(oxy-2,1-ethanediylthio)]bis-" OR "4,4-[Methylenebis(oxy-2,1-ethanediylsulfanediyl)]diphenol" OR "1,7-Bis(4-hydroxyphenylthio)-3,5-dioxaheptane" OR "Bis[2-(4-hydroxyphenylthio)ethoxy]methane " OR ((DD70 OR "DD 70") AND bisphenol))
Chemical: MBHA **CASRN: 5129-00-0** **Synonyms:** Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester; Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester; Acetic acid, bis(p-hydroxyphenyl)-, methyl ester (6CI,7CI,8CI); Methyl 2,2-bis(4-hydroxyphenyl)acetate; Methyl bis(4-hydroxyphenyl)acetate; Methyl bis(p-hydroxyphenyl)acetate; MBHA. *NOTE: MBHA used for numerous other concepts.*		
Database	**Records**	**Search Strategy**
Embase	0/92	"Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester" OR "Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester" OR "Acetic acid, bis(p-hydroxyphenyl)-, methyl ester " OR "Methyl 2,2-bis(4-hydroxyphenyl)acetate" OR "Methyl bis(4-hydroxyphenyl)acetate" OR "Methyl bis(p-hydroxyphenyl)acetate" OR "MBHA" OR 5129-00-0:rn *NOTE: all irrelevant MBHA results*

Appendix Table 3. Literature search strategies		
Pubmed	0/60	"Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester"[tiab] OR "Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester"[tiab] OR "Acetic acid, bis(p-hydroxyphenyl)-, methyl ester "[tiab] OR "Methyl 2,2-bis(4-hydroxyphenyl)acetate"[tiab] OR "Methyl bis(4-hydroxyphenyl)acetate"[tiab] OR "Methyl bis(p-hydroxyphenyl)acetate"[tiab] OR "MBHA"[tiab] OR 5129-00-0[rn] *NOTE: all irrelevant MBHA results*
SciFinder	1/65	5129-00-0 [not relevant]
Scopus	0/104	TITLE-ABS-KEY("Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester" OR "Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester" OR "Acetic acid, bis(p-hydroxyphenyl)-, methyl ester " OR "Methyl 2,2-bis(4-hydroxyphenyl)acetate" OR "Methyl bis(4-hydroxyphenyl)acetate" OR "Methyl bis(p-hydroxyphenyl)acetate" OR "MBHA") OR CASREGNUMBER(5129-00-0) = *NOTE: all irrelevant MBHA results*
Toxline	0/13	"Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester" OR "Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester" OR "Acetic acid, bis(p-hydroxyphenyl)-, methyl ester " OR "Methyl 2,2-bis(4-hydroxyphenyl)acetate" OR "Methyl bis(4-hydroxyphenyl)acetate" OR "Methyl bis(p-hydroxyphenyl)acetate" OR "MBHA" OR "5129-00-0" *NOTE: all irrelevant MBHA results*
Web of Science	0/91	TS=("Benzeneacetic acid, 4-hydroxy-α-(4-hydroxyphenyl)-, methyl ester" OR "Benzeneacetic acid, 4-hydroxy-alpha-(4-hydroxyphenyl)-, methyl ester" OR "Acetic acid, bis(p-hydroxyphenyl)-, methyl ester " OR "Methyl 2,2-bis(4-hydroxyphenyl)acetate" OR "Methyl bis(4-hydroxyphenyl) acetate" OR "Methyl bis(p-hydroxyphenyl)acetate" OR "MBHA") *NOTE: all irrelevant MBHA results*

Appendix Table 3. Literature search strategies		
Chemical: Pergafast 201 **CASRN: 232938-43-1** **Synonyms:** N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea; Benzenesulfonamide, 4-methyl-*N*-[[[3-[[(4-methylphenyl) sulfonyl]oxy]phenyl]amino]carbonyl]-; N-(4-Methylphenylsulfonyl)-N-[3-(4-methylphenylsulfonyloxy)phenyl]urea; N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea; PF 201; Pergafast 201		
Database	**Records**	**Search Strategy**
Embase	0	"N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea" OR "Benzenesulfonamide, 4-methyl-*N*-(((3-(((4-methylphenyl)sulfonyl)oxy)phenyl)amino)carbonyl)-" OR "N-(4-Methylphenylsulfonyl)-N-(3-(4-methylphenylsulfonyloxy)phenyl)urea" OR "N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea" OR "PF 201" OR "Pergafast 201" OR 232938-43-1:rn
Pubmed	0	"N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea"[tiab] OR "Benzenesulfonamide, 4-methyl-*N*-[[[3-[[(4-methylphenyl)sulfonyl]oxy]phenyl]amino]carbonyl]-"[tiab] OR "N-(4-Methylphenylsulfonyl)-N-[3-(4-methylphenylsulfonyloxy)phenyl]urea "[tiab] OR "N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea"[tiab] OR "PF 201"[tiab] OR "Pergafast 201"[tiab] OR 232938-43-1[rn]
SciFinder	2/77	232938-43-1
Scopus	0	TITLE-ABS-KEY("N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea" OR "Benzenesulfonamide, 4-methyl-*N*-[[[3-[[(4-methylphenyl)sulfonyl]oxy]phenyl]amino]carbonyl]-" OR "N-(4-Methylphenylsulfonyl)-N-[3-(4-methylphenylsulfonyloxy)phenyl]urea" OR "N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea" OR "PF 201" OR "Pergafast 201") OR CASREGNUMBER(232938-43-1)
Toxline	0	"N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea" OR "Benzenesulfonamide, 4-methyl-*N*-(((3-(((4-methylphenyl)sulfonyl)oxy)phenyl)amino)carbonyl)-" OR "N-(4-Methylphenylsulfonyl)-N-(3-(4-methylphenylsulfonyloxy)phenyl)urea" OR "N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea" OR "PF 201" OR "Pergafast 201" OR "232938-43-1"
Web of Science	0	TS=("N-(p-Toluenesulfonyl)-N-(3-p-toluenesulfonyloxyphenyl)urea" OR "Benzenesulfonamide, 4-methyl-*N*-[[[3-[[(4-methylphenyl)sulfonyl]oxy]phenyl]amino]carbonyl]-" OR "N-(4-Methylphenylsulfonyl)-N-[3-(4-methylphenylsulfonyloxy)phenyl]urea" OR "N-p-Tolylsulfonyl-N-3-(p-tolylsulfonyloxy)phenylurea" OR "PF 201" OR "Pergafast 201")

Appendix Table 3. Literature search strategies		
Chemical: PHBB **CASRN: 94-18-8** **Synonyms:** Benzoic acid, 4-hydroxy-, phenylmethyl ester; Benzoic acid, p-hydroxy-, benzyl ester (6CI,7CI,8CI); 4-(Benzyloxycarbonyl) phenol; 4-Hydroxybenzoic acid benzyl ester; 4-Hydroxybenzoic acid, phenylmethyl ester; Benzyl 4-hydroxybenzoate; Benzyl 4-hydroxylbenzoate; Benzyl paraben; Benzylparaben [chemspider]; Benzyl Parasept; Benzyl Tegosept; Benzyl p-hydroxybenzoate; Benzylparaben[nm]; NSC 8080; Nipabenzyl; POB-BZ; Parosept; PHBB; Solbrol Z; p-Hydroxybenzoic acid benzyl ester. *NOTE: removed PHBB - used for numerous other concepts.*		
Database	**Records**	**Search Strategy**
Embase	94/139	"Benzoic acid, 4-hydroxy-, phenylmethyl ester" OR "Benzoic acid, p-hydroxy-, benzyl ester" OR "4-(Benzyloxycarbonyl)phenol" OR "p-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid, phenylmethyl ester" OR "Benzyl 4-hydroxybenzoate" OR "Benzyl 4-hydroxylbenzoate" OR "benzyl paraben" OR benzylparaben OR "Benzyl Parasept" OR "Benzyl Tegosept" OR "Benzyl p-hydroxybenzoate" OR "Nipabenzyl" OR "NSC 8080" OR "Parosept" OR "POB-BZ Solbrol Z" OR 94-18-8:rn
Pubmed	42/81	"Benzoic acid, 4-hydroxy-, phenylmethyl ester"[tiab] OR "Benzoic acid, p-hydroxy-, benzyl ester"[tiab] OR "4-(Benzyloxycarbonyl)phenol"[tiab] OR "p-Hydroxybenzoic acid benzyl ester"[tiab] OR "4-Hydroxybenzoic acid benzyl ester"[tiab] OR "4-Hydroxybenzoic acid, phenylmethyl ester"[tiab] OR "Benzyl 4-hydroxybenzoate"[tiab] OR "Benzyl 4-hydroxylbenzoate"[tiab] OR "benzyl paraben"[tiab] OR benzylparaben[nm] OR benzylparaben[tiab] OR "Benzyl Parasept"[tiab] OR "Benzyl Tegosept"[tiab] OR "Benzyl p-hydroxybenzoate"[tiab] OR "Nipabenzyl"[tiab] OR "NSC 8080"[tiab] OR "Parosept"[tiab] OR "POB-BZ Solbrol Z" OR 94-18-8[rn]
SciFinder	238/1202	94-18-8
Scopus	94/166	TITLE-ABS-KEY("Benzoic acid, 4-hydroxy-, phenylmethyl ester" OR "Benzoic acid, p-hydroxy-, benzyl ester" OR "4-(Benzyloxycarbonyl)phenol" OR "p-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid, phenylmethyl ester" OR "Benzyl 4-hydroxybenzoate" OR "Benzyl 4-hydroxylbenzoate" OR "benzyl paraben" OR benzylparaben OR "Benzyl Parasept" OR "Benzyl Tegosept" OR "Benzyl p-hydroxybenzoate" OR "Nipabenzyl" OR "NSC 8080" OR "Parosept" OR "POB-BZ Solbrol Z") OR CASREGNUMBER(94-18-8) *Subject areas included*: pharm, med, biochem, enviro sci., ag/bio. immuno

Appendix Table 3. Literature search strategies		
Toxline	55	"Benzoic acid, 4-hydroxy-, phenylmethyl ester" OR "Benzoic acid, p-hydroxy-, benzyl ester" OR "4-Benzyloxycarbonyl phenol" OR "p-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid, phenylmethyl ester" OR "Benzyl 4-hydroxybenzoate" OR "Benzyl 4-hydroxylbenzoate" OR "benzyl paraben" OR benzylparaben OR "Benzyl Parasept" OR "Benzyl Tegosept" OR "Benzyl p-hydroxybenzoate" OR "Nipabenzyl" OR "NSC 8080" OR "Parosept" OR "POB-BZ Solbrol Z" OR "94-18-8"
Web of Science	53/100	TS=("Benzoic acid, 4-hydroxy-, phenylmethyl ester" OR "Benzoic acid, p-hydroxy-, benzyl ester" OR "4-(Benzyloxycarbonyl)phenol" OR "p-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid benzyl ester" OR "4-Hydroxybenzoic acid, phenylmethyl ester" OR "Benzyl 4-hydroxybenzoate" OR "Benzyl 4-hydroxylbenzoate" OR "benzyl paraben" OR benzylparaben OR "Benzyl Parasept" OR "Benzyl Tegosept" OR "Benzyl p-hydroxybenzoate" OR "Nipabenzyl" OR "NSC 8080" OR "Parosept" OR "POB-BZ Solbrol Z")
Chemical: TBBPA	**CASRN: 79-94-7; Alternate CAS: 25639-54-7, 26446-62-8, 121839-52-9; OLD: 7300-23-4, 30496-13-0, 51253-31-7, 76341-26-9, 107719-55-1, 108608-60-2, 110670-65-0, 124779-54-0, 131891-38-8, 186673-39-2, 224951-26-2**	
Synonyms: bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane Phenol, 4,4-(1-methylethylidene)bis[2,6-dibromo-; Phenol, 4,4-isopropylidenebis[2,6-dibromo- (6CI,7CI,8CI); 2,2-Bis(3,5-dibromo-4-hydroxyphenyl)propane; 2,2-Bis(4-hydroxy-3,5-dibromophenyl)propane; 2,2,6,6-Tetrabromobisphenol A; 3,3,5,5-Tetrabromobisphenol A; 3,5,3,5-Tetrabromobisphenol A; 4,4-(1-Methylethylidene)bis[2,6-dibromophenol]; 4,4-(2,2-Propanediyl)bis(2,6-dibromophenol); 4,4-Isopropylidenebis[2,6-dibromophenol]; BA 59; BA 59BP; BA 59P; Bromdian; CP 2000; FCP 2010; FG 2000; FR 1524; Fire Guard 2000; Firemaster BP 4A; Flame Cut 120G; Flame Cut 120R; GLCBA 59P; NSC 59775; PB 100; RB 100; Saytex CP 2000; Saytex RB 100; Saytex RB 100PC; T 0032; TBBPA; Tetrabromobisphenol A[nm]; Tetrabromodian; Tetrabromodiphenylolpropane		
Database	**Records**	**Search Strategy**

Appendix Table 3. Literature search strategies		
Embase	543	"bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane" OR "Phenol, 4,4-(1-methylethylidene)bis(2,6-dibromo-" OR "Phenol, 4,4-isopropylidenebis(2,6-dibromo-" OR "2,2-Bis(3,5-dibromo-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dibromophenyl) propane" OR "tetrabromobisphenol A" OR "2,2,6,6-Tetrabromobisphenol A" OR "3,3,5,5-Tetrabromobisphenol A" OR "3,5,3,5-Tetrabromobisphenol A" OR "4,4-(1-Methylethylidene)bis(2,6-dibromophenol)" OR "4,4-(2,2-Propanediyl)bis(2,6-dibromophenol)" OR "4,4-Isopropylidenebis(2,6-dibromophenol)" OR "BA 59" OR "BA 59BP" OR "BA 59P" OR "Bromdian" OR "CP 2000" OR "FCP 2010" OR "FG 2000" OR "FR 1524" OR "Fire Guard 2000" OR "Firemaster BP 4A" OR "Flame Cut 120G" OR "Flame Cut 120R" OR "GLCBA 59P" OR "NSC 59775" OR "PB 100" OR "RB 100" OR "Saytex CP 2000" OR "Saytex RB 100" OR "Saytex RB 100PC" OR "T 0032" OR "TBBPA" OR "TBBP A" OR "Tetrabromodian" OR "Tetrabromodiphenylolpropane" OR 79-94-7:rn OR 25639-54-7:rn OR 26446-62-8:rn OR 121839-52-9:rn OR 7300-23-4:rn OR 30496-13-0:rn OR 51253-31-7:rn OR 76341-26-9:rn OR 107719-55-1:rn OR 108608-60-2:rn OR 110670-65-0:rn OR 124779-54-0:rn OR 131891-38-8:rn OR 186673-39-2:rn OR 224951-26-2:rn
Pubmed	414	Tetrabromobisphenol A[nm] OR "bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane"[tiab] OR "Phenol, 4,4-(1-methylethylidene)bis(2,6-dibromo-"[tiab] OR "Phenol, 4,4-isopropylidenebis(2,6-dibromo-"[tiab] OR "2,2-Bis(3,5-dibromo-4-hydroxyphenyl) propane"[tiab] OR "2,2-Bis(4-hydroxy-3,5-dibromophenyl)propane"[tiab] OR "tetrabromobisphenol A"[tiab] OR "2,2,6,6-Tetrabromobisphenol A"[tiab] OR "3,3,5,5-Tetrabromobisphenol A"[tiab] OR "3,5,3,5-Tetrabromobisphenol A"[tiab] OR "4,4-(1-Methylethylidene)bis(2,6-dibromophenol)"[tiab] OR "4,4-(2,2-Propanediyl)bis(2,6-dibromophenol)"[tiab] OR "4,4-Isopropylidenebis(2,6-dibromophenol)"[tiab] OR "BA 59"[tiab] OR "BA 59BP"[tiab] OR "BA 59P"[tiab] OR "Bromdian"[tiab] OR "CP 2000"[tiab] OR "FCP 2010"[tiab] OR "FG 2000"[tiab] OR "FR 1524"[tiab] OR "Fire Guard 2000"[tiab] OR "Firemaster BP 4A"[tiab] OR "Flame Cut 120G"[tiab] OR "Flame Cut 120R"[tiab] OR "GLCBA 59P"[tiab] OR "NSC 59775"[tiab] OR "PB 100"[tiab] OR "RB 100"[tiab] OR "Saytex CP 2000"[tiab] OR "Saytex RB 100"[tiab] OR "Saytex RB 100PC"[tiab] OR "T 0032"[tiab] OR "TBBPA"[tiab] OR "TBBP A"[tiab] OR "Tetrabromodian"[tiab] OR "Tetrabromodiphenylolpropane"[tiab] OR 79-94-7[rn] OR "25639-54-7"[rn] OR "26446-62-8"[rn] OR "121839-52-9"[rn] OR "7300-23-4"[rn] OR "30496-13-0"[rn] OR "51253-31-7"[rn] OR "76341-26-9"[rn] OR "107719-55-1"[rn] OR "108608-60-2"[rn] OR "110670-65-0"[rn] OR "124779-54-0"[rn] OR "131891-38-8"[rn] OR "186673-39-2"[rn] OR "224951-26-2"[rn] *NOTE: excluded Pb100 or RB100 - pentobarbital, lead, partition coefficients*
SciFinder	1239/3209	79-94-7

Appendix Table 3. Literature search strategies		
Scopus	528/787	TITLE-ABS-KEY("bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane" OR "Phenol, 4,4-(1-methylethylidene)bis(2,6-dibromo-" OR "Phenol, 4,4-isopropylidenebis(2,6-dibromo-" OR "2,2-Bis(3,5-dibromo-4-hydroxyphenyl) propane" OR "2,2-Bis(4-hydroxy-3,5-dibromophenyl)propane" OR "tetrabromobisphenol A" OR "2,2,6,6-Tetrabromobisphenol A" OR "3,3,5,5-Tetrabromobisphenol A" OR "3,5,3,5-Tetrabromobisphenol A" OR "4,4-(1-Methylethylidene)bis(2,6-dibromophenol)" OR "4,4-(2,2-Propanediyl)bis(2,6-dibromophenol)" OR "4,4-Isopropylidenebis(2,6-dibromophenol)" OR "BA 59" OR "BA 59BP" OR "BA 59P" OR "Bromdian" OR "CP 2000" OR "FCP 2010" OR "FG 2000" OR "FR 1524" OR "Fire Guard 2000" OR "Firemaster BP 4A" OR "Flame Cut 120G" OR "Flame Cut 120R" OR "GLCBA 59P" OR "NSC 59775" OR "PB 100" OR "RB 100" OR "Saytex CP 2000" OR "Saytex RB 100" OR "Saytex RB 100PC" OR "T 0032" OR "TBBPA" OR "TBBP A" OR "Tetrabromodian" OR "Tetrabromodiphenylolpropane") OR CASREGNUMBER(79-94-7 OR 25639-54-7 OR 26446-62-8 OR 121839-52-9 OR 7300-23-4 OR 30496-13-0 OR 51253-31-7 OR 76341-26-9 OR 107719-55-1 OR 108608-60-2 OR 110670-65-0 OR 124779-54-0 OR 131891-38-8 OR 186673-39-2 OR 224951-26-2) *Subject areas included*: envirosci, pharm, biochem, med, ag/bio, immuno, vet
Toxline	471	"bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane" OR "Phenol, 4,4-(1-methylethylidene)bis(2,6-dibromo-" OR "Phenol, 4,4-isopropylidenebis(2,6-dibromo-" OR "2,2-Bis(3,5-dibromo-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dibromophenyl)propane" OR "tetrabromobisphenol A" OR "2,2,6,6-Tetrabromobisphenol A" OR "3,3,5,5-Tetrabromobisphenol A" OR "3,5,3,5-Tetrabromobisphenol A" OR "4,4-(1-Methylethylidene)bis(2,6-dibromophenol)" OR "4,4-(2,2-Propanediyl)bis(2,6-dibromophenol)" OR "4,4-Isopropylidenebis(2,6-dibromophenol)" OR "BA 59" OR "BA 59BP" OR "BA 59P" OR "Bromdian" OR "CP 2000" OR "FCP 2010" OR "FG 2000" OR "FR 1524" OR "Fire Guard 2000" OR "Firemaster BP 4A" OR "Flame Cut 120G" OR "Flame Cut 120R" OR "GLCBA 59P" OR "NSC 59775" OR "PB 100" OR "RB 100" OR "Saytex CP 2000" OR "Saytex RB 100" OR "Saytex RB 100PC" OR "T 0032" OR "TBBPA" OR "TBBP A" OR "Tetrabromodian" OR "Tetrabromodiphenylolpropane " OR "79-94-7" OR "25639-54-7" OR "26446-62-8" OR "121839-52-9" OR "7300-23-4" OR "30496-13-0" OR "51253-31-7" OR "76341-26-9" OR "107719-55-1" OR "108608-60-2" OR "110670-65-0" OR "124779-54-0" OR "131891-38-8" OR "186673-39-2" OR "224951-26-2" *NOTE: excluded Pb100 or RB100 - pentobarbital, lead, partition coefficients*

Appendix Table 3. Literature search strategies		
Web of Science	536/701	TS=("bis(2,3-dibromopropylether)-2,2-bis(3,5-dibromo-4-(2,3-dibromopropoxy)phenyl)propane" OR "Phenol, 4,4-(1-methylethylidene)bis[2,6-dibromo-" OR "Phenol, 4,4-isopropylidenebis[2,6-dibromo-" OR "2,2-Bis(3,5-dibromo-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dibromophenyl)propane" OR "tetrabromobisphenol A" OR "2,2,6,6-Tetrabromobisphenol A" OR "3,3,5,5-Tetrabromobisphenol A" OR "3,5,3,5-Tetrabromobisphenol A" OR "4,4-(1-Methylethylidene)bis[2,6-dibromophenol]" OR "4,4-(2,2-Propanediyl)bis(2,6-dibromophenol)" OR "4,4-Isopropylidenebis[2,6-dibromophenol]" OR "BA 59" OR "BA 59BP" OR "BA 59P" OR "Bromdian" OR "CP 2000" OR "FCP 2010" OR "FG 2000" OR "FR 1524" OR "Fire Guard 2000" OR "Firemaster BP 4A" OR "Flame Cut 120G" OR "Flame Cut 120R" OR "GLCBA 59P" OR "NSC 59775" OR "PB 100" OR "RB 100" OR "Saytex CP 2000" OR "Saytex RB 100" OR "Saytex RB 100PC" OR "T 0032" OR "TBBPA" OR "TBBP A" OR "Tetrabromodian" OR Tetrabromodiphenylolpropane) *NOTE: excluded Pb100 or RB100 - pentobarbital, lead, partition coefficients* *Categories refined by*: enviro sci, tox, chem analyt, biochem res, pharm, peoh, biochem, food sci, cell bio, endo/metab, chem med, bio, med res exper, pathol, androl
Chemical: TCBPA	**CASRN: 79-95-8; OLD: 4112-94-1, 27360-90-3, 29155-33-7**	
Synonyms: Phenol, 4,4-(1-methylethylidene)bis[2,6-dichloro-; Phenol, 4,4-isopropylidenebis[2,6-dichloro- (6Cl,8Cl); 2,2-Bis(3,5-dichloro-4-hydroxyphenyl)propane; 2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane; 2,2-Bis[3,5-dichloro-4-oxyphenyl]propane; 2,2,6,6-Tetrachlorobisphenol A; 3,3,5,5-Tetrachlorobisphenol A; 3,5,3,5-Tetrachlorobisphenol A; 4,4-(1-methylethylidene)bis(2,6-dichlorophenol); 4,4-Isopropylidenebis[2,6-dichlorophenol]; NSC 18248; NSC 67465; TCBPA; Tetrachlorobisphenol A; Tetrachlorodian[nm]		
Database	**Records**	**Search Strategy**
Embase	56	"Phenol, 4,4-(1-methylethylidene)bis(2,6-dichloro-" OR "Phenol, 4,4-isopropylidenebis(2,6-dichloro- " OR "2,2-Bis(3,5-dichloro-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane" OR "2,2-Bis(3,5-dichloro-4-oxyphenyl)propane" OR "2,2,6,6-Tetrachlorobisphenol A" OR "3,3,5,5-Tetrachlorobisphenol A" OR "3,5,3,5-Tetrachlorobisphenol A" OR "4,4-(1-methylethylidene)bis(2,6-dichlorophenol)" OR "4,4-Isopropylidenebis(2,6-dichlorophenol)" OR "NSC 18248" OR "NSC 67465" OR "TCBPA" OR "Tetrachlorobisphenol A" OR tetrachlorodian OR 79-95-8:RN OR 4112-94-1:rn OR 27360-90-3:rn OR 29155-33-7:rn

Appendix Table 3. Literature search strategies		
Pubmed	45	Tetrachlorodian[nm] OR "Phenol, 4,4-(1-methylethylidene)bis(2,6-dichloro-"[tiab] OR "Phenol, 4, 4-isopropylidenebis(2,6-dichloro- "[tiab] OR "2,2-Bis(3,5-dichloro-4-hydroxyphenyl) propane"[tiab] OR "2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane"[tiab] OR "2,2-Bis(3,5-dichloro-4-oxyphenyl)propane"[tiab] OR "2,2,6,6-Tetrachlorobisphenol A"[tiab] OR "3,3,5,5-Tetrachlorobisphenol A"[tiab] OR "3,5,3,5-Tetrachlorobisphenol A"[tiab] OR "4,4-(1-methylethylidene)bis(2,6-dichlorophenol)"[tiab] OR "4,4-Isopropylidenebis(2,6-dichlorophenol)"[tiab] OR "NSC 18248"[tiab] OR "NSC 67465"[tiab] OR "TCBPA"[tiab] OR "Tetrachlorobisphenol A"[tiab] OR 79-95-8[rn] OR 4112-94-1[rn] OR 27360-90-3[rn] OR 29155-33-7[rn]
SciFinder	150/403	79-95-8
Scopus	67/88	TITLE-ABS-KEY("Phenol, 4,4-(1-methylethylidene)bis(2,6-dichloro-" OR "Phenol, 4,4-isopropylidenebis(2,6-dichloro- " OR "2,2-Bis(3,5-dichloro-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane" OR "2,2-Bis(3,5-dichloro-4-oxyphenyl)propane" OR "2,2,6,6-Tetrachlorobisphenol A" OR "3,3,5,5-Tetrachlorobisphenol A" OR "3,5,3,5-Tetrachlorobisphenol A" OR "4,4-(1-methylethylidene)bis(2,6-dichlorophenol)" OR "4,4-Isopropylidenebis(2,6-dichlorophenol)" OR "NSC 18248" OR "NSC 67465" OR "TCBPA" OR "Tetrachlorobisphenol A" OR tetrachlorodian) OR CASREGNUMBER(79-95-8 OR 4112-94-1 OR 27360-90-3 OR 29155-33-7) *Subject areas included*: enviro sci, chem, pharm, biochem, med, ag/bio, immuno
Toxline	35	"Phenol, 4,4-(1-methylethylidene)bis(2,6-dichloro-" OR "Phenol, 4,4-isopropylidenebis(2,6-dichloro- " OR "2,2-Bis(3,5-dichloro-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane" OR "2,2-Bis(3,5-dichloro-4-oxyphenyl)propane" OR "2,2,6,6-Tetrachlorobisphenol A" OR "3,3,5,5-Tetrachlorobisphenol A" OR "3,5,3,5-Tetrachlorobisphenol A" OR "4,4-(1-methylethylidene)bis(2,6-dichlorophenol)" OR "4,4-Isopropylidenebis(2,6-dichlorophenol)" OR "NSC 18248" OR "NSC 67465" OR "TCBPA" OR "Tetrachlorobisphenol A" OR tetrachlorodian OR "79-95-8" OR "4112-94-1" OR "27360-90-3" OR "29155-33-7"

Appendix Table 3. Literature search strategies		
Web of Science	57/ 81	TS=("Phenol, 4,4-(1-methylethylidene)bis[2,6-dichloro-" OR "Phenol, 4,4-isopropylidenebis[2,6-dichloro- " OR "2,2-Bis(3,5-dichloro-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dichlorophenyl)propane" OR "2,2-Bis[3,5-dichloro-4-oxyphenyl]propane" OR "2,2,6,6-Tetrachlorobisphenol A" OR "3,3,5,5-Tetrachlorobisphenol A" OR "3,5,3,5-Tetrachlorobisphenol A" OR "4,4-(1-methylethylidene)bis(2,6-dichlorophenol)" OR "4,4-Isopropylidenebis[2,6-dichlorophenol]" OR "NSC 18248" OR "NSC 67465" OR "TCBPA" OR "Tetrachlorobisphenol A" OR tetrachlorodian) *Categories refined by*: enviro sci, chem analt, tox, biochem res, pharm, peoh, endo, food sci, biochem, med research
Chemical: TGSA **CASRN: 41481-66-7** **Synonyms:** Phenol, 4,4-sulfonylbis[2-(2-propen-1-yl)-; Phenol, 4,4-sulfonylbis[2-(2-propenyl)- (9CI); 3,3-Diallyl-4,4-dihydroxybiphenyl sulfone; 3,3-Diallyl-4,4-dihydroxydiphenylsulfone; 4,4-Sulfonylbis(2-allylphenol); Bis(3-allyl-4-hydroxyphenyl) sulfone; Bis(4-hydroxy-3-allylphenyl) sulfone; TG-SA; TGSA; TGSH. *NOTE: TGSH commonly refers to total glutathione levels*		
Database	**Records**	**Search Strategy**
Embase	0/13	"Phenol, 4,4-sulfonylbis(2-(2-propen-1-yl)-" OR "Phenol, 4,4-sulfonylbis(2-(2-propenyl)" OR "3,3-Diallyl-4,4-dihydroxybiphenyl sulfone" OR "3,3-Diallyl-4,4-dihydroxydiphenylsulfone" OR "4,4-Sulfonylbis(2-allylphenol)" OR "Bis(3-allyl-4-hydroxyphenyl) sulfone" OR "Bis(4-hydroxy-3-allylphenyl) sulfone" OR "TG-SA" OR TGSA OR (TGSH NOT glutathione) OR 41481-66-7:rn *NOTE: none relevant, all glutathione related*
Pubmed	0/13	"Phenol, 4,4-sulfonylbis(2-(2-propen-1-yl)-"[tiab] OR "Phenol, 4,4-sulfonylbis(2-(2-propenyl)"[tiab] OR "3,3-Diallyl-4,4-dihydroxybiphenyl sulfone"[tiab] OR "3,3-Diallyl-4,4-dihydroxydiphenylsulfone"[tiab] OR "4,4-Sulfonylbis(2-allylphenol)"[tiab] OR "Bis(3-allyl-4-hydroxyphenyl) sulfone"[tiab] OR "Bis(4-hydroxy-3-allylphenyl) sulfone"[tiab] OR "TG-SA"[tiab] OR TGSA[tiab] OR (TGSH[tiab] NOT glutathione[tiab]) OR 41481-66-7[rn]
SciFinder	7/468	41481-66-7
Scopus	0	TITLE-ABS-KEY("Phenol, 4,4-sulfonylbis(2-(2-propen-1-yl)-" OR "Phenol, 4,4-sulfonylbis(2-(2-propenyl)" OR "3,3-Diallyl-4,4-dihydroxybiphenyl sulfone" OR "3,3-Diallyl-4,4-dihydroxydiphenylsulfone" OR "4,4-Sulfonylbis(2-allylphenol)" OR "Bis(3-allyl-4-hydroxyphenyl) sulfone" OR "Bis(4-hydroxy-3-allylphenyl) sulfone" OR "TG-SA" OR TGSA OR (TGSH NOT glutathione)) OR CASREGNUMBER(41481-66-7)

Appendix Table 3. Literature search strategies		
Toxline	0/2	"Phenol, 4,4-sulfonylbis(2-(2-propen-1-yl)-" OR "Phenol, 4,4-sulfonylbis(2-(2-propenyl)" OR "3,3-Diallyl-4,4-dihydroxybiphenyl sulfone" OR "3,3-Diallyl-4,4-dihydroxydiphenylsulfone" OR "4,4-Sulfonylbis(2-allylphenol)" OR "Bis(3-allyl-4-hydroxyphenyl) sulfone" OR "Bis(4-hydroxy-3-allylphenyl) sulfone" OR "TG-SA" OR TGSA OR (TGSH NOT glutathione) OR "41481-66-7" *NOTE: none relevant, all glutathione related*
Web of Science	0/19	TS=("Phenol, 4,4-sulfonylbis[2-(2-propen-1-yl)-" OR "Phenol, 4,4-sulfonylbis[2-(2-propenyl)" OR "3,3-Diallyl-4,4-dihydroxybiphenyl sulfone" OR "3,3-Diallyl-4,4-dihydroxydiphenylsulfone" OR "4,4-Sulfonylbis(2-allylphenol)" OR "Bis(3-allyl-4-hydroxyphenyl) sulfone" OR "Bis(4-hydroxy-3-allylphenyl) sulfone" OR "TG-SA" OR TGSA OR (TGSH NOT glutathione)) *NOTE: none relevant, all glutathione related*
Chemical: TMBPA	**CASRN: 5613-46-7; OLD: 50984-82-2, 56345-14-3, 790150-84-4**	
Synonyms: Phenol, 4,4-(1-methylethylidene)bis[2,6-dimethyl-; 2,6-Xylenol, 4,4-isopropylidenedi- (7CI,8CI); 2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane; 2,2-Bis(4-hydroxy-3,5-dimethylphenyl)propane; 3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane; 4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol); 4,4-Isopropylidenebis(2,6-dimethylphenol); 4,4-Isopropylidenedi-2,6-xylenol; Bisxylenol A; NSC 73730; Tetramethylbisphenol A; TMBPA		
Database	**Records**	**Search Strategy**
Embase	11	"Phenol, 4,4-(1-methylethylidene)bis[2,6-dimethyl-" OR "2,6-Xylenol, 4,4-isopropylidenedi- " OR "2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dimethylphenyl) propane" OR "3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol)" OR "4,4-Isopropylidenebis(2,6-dimethylphenol)" OR "4,4-Isopropylidenedi-2,6-xylenol" OR "Bisxylenol A" OR "NSC 73730" OR "Tetramethylbisphenol A" OR "TMBPA" OR 5613-46-7:rn OR 50984-82-2:rn OR 56345-14-3:rn OR 790150-84-4:rn
Pubmed	6	"Phenol, 4,4-(1-methylethylidene)bis(2,6-dimethyl-"[tiab] OR "2,6-Xylenol, 4,4-isopropylidenedi-"[tiab] OR "2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane"[tiab] OR "2,2-Bis(4-hydroxy-3,5-dimethylphenyl)propane"[tiab] OR "3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane"[tiab] OR "4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol)"[tiab] OR "4,4-Isopropylidenebis(2,6-dimethylphenol)"[tiab] OR "4,4-Isopropylidenedi-2,6-xylenol"[tiab] OR "Bisxylenol A"[tiab] OR "NSC 73730"[tiab] OR "Tetramethylbisphenol A"[tiab] OR TMBPA[tiab] OR 5613-46-7[rn] OR 50984-82-2[rn] OR 56345-14-3[rn] OR 790150-84-4[rn]
SciFinder	49/313	5613-46-7

Appendix Table 3. Literature search strategies		
Scopus	28/79	TITLE-ABS-KEY("Phenol, 4,4-(1-methylethylidene)bis[2,6-dimethyl-" OR "2,6-Xylenol, 4,4-isopropylidenedi- " OR "2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dimethylphenyl)propane" OR "3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol)" OR "4,4-Isopropylidenebis(2,6-dimethylphenol)" OR "4,4-Isopropylidenedi-2,6-xylenol" OR "Bisxylenol A" OR "NSC 73730" OR "Tetramethylbisphenol A" OR TMBPA) OR CASREGNUMBER(5613-46-7 OR 50984-82-2 OR 56345-14-3 OR 790150-84-4) *Subject areas included*: chem, pharma, enviro sci
Toxline	2	"Phenol, 4,4-(1-methylethylidene)bis(2,6-dimethyl-" OR "2,6-Xylenol, 4,4-isopropylidenedi- " OR "2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dimethylphenyl) propane" OR "3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol)" OR "4,4-Isopropylidenebis(2,6-dimethylphenol)" OR "4,4-Isopropylidenedi-2,6-xylenol" OR "Bisxylenol A" OR "NSC 73730" OR "Tetramethylbisphenol A" OR TMBPA OR "5613-46-7" OR "50984-82-2" OR "56345-14-3" OR "790150-84-4"
Web of Science	8/70	TS=("Phenol, 4,4-(1-methylethylidene)bis[2,6-dimethyl-" OR "2,6-Xylenol, 4,4-isopropylidenedi- " OR "2,2-Bis(3,5-dimethyl-4-hydroxyphenyl)propane" OR "2,2-Bis(4-hydroxy-3,5-dimethylphenyl) propane" OR "3,3,5,5-Tetramethyl-4,4-dihydroxydiphenyl-2,2-propane" OR "4,4-(2,2-Propanediyl)bis(2,6-dimethylphenol)" OR "4,4-Isopropylidenebis(2,6-dimethylphenol)" OR "4,4-Isopropylidenedi-2,6-xylenol" OR "Bisxylenol A" OR "NSC 73730" OR "Tetramethylbisphenol A" OR TMBPA) = 8/70 *Categories refined by*: tox, chem analyt, enviro sci, med res, pharm
Chemical: UU **CASRN: 321860-75-7** **Synonyms:** Urea Urethane Compound; Phenol, reaction products with 4,4-sulfonylbis[benzenamine] and 2,4-TDI		
Database	**Records**	**Search Strategy**
Embase	0	"urea urethane compound"
Pubmed	0	"urea urethane compound"[tiab]
SciFinder	0	321860-75-7 Searched by "urea urethane compound"=12 [11 patents and other spectroscopy]

Appendix Table 3. Literature search strategies		
Scopus	0/1	TITLE-AS-KEY("urea urethane compound") [not relevant, same as Web of Science result]
Toxline	0	"321860-75-7"
Web of Science	0/1	TS=("urea urethane compound" U) [*not relevant – spectroscopic characterization*]
Note: Records are shown as Number retrieved/Total number references.		

Appendix 3. Risk-of-Bias Criteria

The OHAT risk of bias tool for human and animal studies (version date January 2015 and available at http://ntp.niehs.nih.gov/go/38673) reflects OHAT's current best practices and provides the detailed discussion and instructions for the risk-of-bias practices used in this evaluation. The OHAT tool uses a single set of questions (also called "elements" or "domains") to assess risk of bias across various study types to facilitate consideration of conceptually similar potential sources of bias across the human and animal evidence streams with a common terminology. Individual risk-of-bias questions are designated as only applicable to certain study designs (e.g., cohort studies or experimental animal studies), and a subset of the questions apply to each study design (**Table 7**).

The specific criteria used to assess risk of bias for this evaluation are outlined below for human/observational studies and experimental animal studies. Based on the initial literature inventory we do not expect any controlled exposure studies in humans (i.e., human controlled trials), cross-sectional, or case series studies and therefore have not included risk-of-bias criteria for those study designs. If relevant human controlled trials, cross-sectional, or case series studies of any of the BPA analogues are identified, the criteria from the January 2015 OHAT risk of bias tool will be used to evaluate risk of bias.

Observational Studies (Human or Wildlife Studies)

Cohort studies

1. Was administered dose or exposure level adequately randomized? [NA]

2. Was allocation to study groups adequately concealed? [NA]

3. Did selection of study participants result in the appropriate comparison groups?

Definitely Low Risk of Bias (++)
• Direct evidence that subjects (both exposed and non-exposed) were similar (e.g., recruited from the same eligible population, recruited with the same method of ascertainment using the same inclusion and exclusion criteria, and were of similar age and health status), recruited within the same time frame, and had the similar participation/response rates, • **Note:** A study will be considered low risk of bias if baseline characteristics of groups differed but these differences were considered as potential confounding or stratification variables (see question #4),
Probably Low Risk of Bias (+)
• Indirect evidence that subjects (both exposed and non-exposed) were similar (e.g., recruited from the same eligible population, recruited with the same method of ascertainment using the same inclusion and exclusion criteria, and were of similar age and health status), recruited within the same time frame, and had the similar participation/response rates, • **OR** differences between groups would not appreciably bias results.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that subjects (both exposed and non-exposed) were not similar, recruited within very different time frames, or had the very different participation/response rates, • **OR** there is insufficient information provided about the comparison group including a different rate of non-response without an explanation (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that subjects (both exposed and non-exposed) were not similar, recruited within very different time frames, or had the very different participation/response rates.

4. Did study design or analysis account for important confounding and modifying variables?

Definitely Low Risk of Bias (++)
• Direct evidence that appropriate adjustments or explicit considerations were made for the variables listed below as potential confounders and/or effect measure modifiers in the final analyses through the use of statistical models to reduce research-specific bias including standardization, matching, adjustment in multivariate model, stratification, propensity scoring, or other methods that were appropriately justified. Acceptable consideration of appropriate adjustment factors includes cases when the factor is not included in the final adjustment model because the author conducted analyses that indicated it did not need to be included, • **AND** there is direct evidence that primary covariates and confounders were assessed using valid and reliable measurements, • **AND** there is direct evidence that other exposures anticipated to bias results were not present or were appropriately measured and adjusted for. In occupational studies or studies of contaminated sites, other chemical exposures known to be associated with those settings were appropriately considered. • **Note:** The following variables may be considered as potential confounders and/or effect measure modifiers for the relationship between BPA analogue exposure and health outcomes: age, sex, race/ethnicity, body mass index, variables that represent socioeconomic status (e.g., educational level, household income), and the potential for occupational exposure to other chemicals.
Probably Low Risk of Bias (+)
• Indirect evidence that appropriate adjustments were made, • **OR** it is deemed that not considering or only considering a partial list of covariates or confounders in the final analyses would not appreciably bias results, • **AND** there is evidence (direct or indirect) that covariates and confounders considered were assessed using valid and reliable measurements, • **OR** it is deemed that the measures used would not appreciably bias results (i.e., the authors justified the validity of the measures from previously published research), • **AND** there is evidence (direct or indirect) that other co-exposures anticipated to bias results were not present or were appropriately adjusted for, • **OR** it is deemed that co-exposures present would not appreciably bias results. • **Note:** this includes insufficient information provided on co-exposures in general population studies.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the distribution of important covariates and known confounders differed between the groups and was not appropriately adjusted for in the final analyses, • **OR** there is insufficient information provided about the distribution of known confounders (record “NR” as basis for answer), • **OR** there is indirect evidence that covariates and confounders considered were assessed using measurements of unknown validity, • **OR** there is insufficient information provided about the measurement techniques used to assess covariates and confounders considered (record “NR” as basis for answer), • **OR** there is indirect evidence that there was an unbalanced provision of additional co-exposures across the primary study groups, which were not appropriately adjusted for, • **OR** there is insufficient information provided about co-exposures in occupational studies or studies of contaminated sites where high exposures to other chemical exposures would have been reasonably anticipated (record “NR” as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the distribution of important covariates and known confounders differed between the groups, confounding was demonstrated, and was not appropriately adjusted for in the final analyses, • **OR** there is direct evidence that covariates and confounders considered were assessed using non valid measurements, • **OR** there is direct evidence that there was an unbalanced provision of additional co-exposures across the primary study groups, which were not appropriately adjusted for.

5. Were experimental conditions identical across study groups? [NA]

6. Were the research personnel blinded to the study group during the study? [NA]

7. Were outcome data complete without attrition or exclusion from analysis?

Definitely Low Risk of Bias (++)
• Direct evidence that loss of subjects (i.e., incomplete outcome data) was adequately addressed and reasons were documented when human subjects were removed from a study. • **Note**: Acceptable handling of subject attrition includes: very little missing outcome data; reasons for missing subjects unlikely to be related to outcome (for survival data, censoring unlikely to be introducing bias); missing outcome data balanced in numbers across study groups, with similar reasons for missing data across groups, • **OR** missing data have been imputed using appropriate methods and characteristics of subjects lost to follow up or with unavailable records are described in identical way and are not significantly different from those of the study participants.
Probably Low Risk of Bias (+)
• Indirect evidence that loss of subjects (i.e., incomplete outcome data) was adequately addressed and reasons were documented when human subjects were removed from a study, • **OR** it is deemed that the proportion lost to follow-up would not appreciably bias results. This would include reports of no statistical differences in characteristics of subjects lost to follow up or with unavailable records from those of the study participants. Generally, the higher the ratio of participants with missing data to participants with events, the greater potential there is for bias. For studies with a long duration of follow-up, some withdrawals for such reasons are inevitable.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that loss of subjects (i.e., incomplete outcome data) was unacceptably large and not adequately addressed, • **OR** there is insufficient information provided about numbers of subjects lost to follow-up (record “NR” as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that loss of subjects (i.e., incomplete outcome data) was unacceptably large and not adequately addressed. • **Note**: Unacceptable handling of subject attrition includes: reason for missing outcome data likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across study groups; or potentially inappropriate application of imputation.

8. Can we be confident in the exposure characterization?

Definitely Low Risk of Bias (++)
• Direct evidence that exposure was consistently assessed (i.e., under the same method and time-frame) using well-established methods that directly measure exposure (e.g., measurement of BPA analogues in blood, serum, or plasma), • **OR** exposure was assessed using less-established methods that directly measure exposure and are validated against well-established methods, • **AND** exposure was assessed in a relevant time-window for development of the outcome, • **AND** there is sufficient range or variation in exposure measurements across groups to potentially identify associations with health outcomes, • **AND** there is evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished, • **AND** the study used spiked samples to confirm assay performance. • **Note:** Use of method blanks is necessary to identify potential sources of contamination in blood and urine but cannot rule out all possible sources of contamination (Ye *et al.* 2012).
Probably Low Risk of Bias (+)
• Indirect evidence that the exposure was consistently assessed using well-established methods that directly measure exposure), • **OR** exposure was assessed using indirect measures (e.g., drinking water levels and residency, questionnaire or occupational exposure assessment by a certified industrial hygienist) that have been validated or empirically shown to be consistent with methods that directly measure exposure (i.e., inter-methods validation: one method vs. another), • **AND** exposure was assessed in a relevant time-window for development of the outcome, • **AND** there is sufficient range or variation in exposure measurements across groups to potentially identify associations with health outcomes (at a minimum from high exposure or ever exposed from low exposure or never exposed), • **AND** there is evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the exposure was assessed using poorly validated methods that directly measure exposure, • **OR** there is evidence that the exposure was assessed using indirect measures that have not been validated or empirically shown to be consistent with methods that directly measure exposure (e.g., questionnaire, job-exposure matrix or self-report without validation) (record "NR" as basis for answer), • **OR** there is insufficient information provided about the exposure assessment, including validity and reliability, but no evidence for concern about the method used (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the exposure was assessed using methods with poor validity, • **OR** evidence of uncontrolled contamination, • **OR** evidence of exposure misclassification (e.g., differential recall of self-reported exposure).

9. Can we be confident in the outcome assessment?

Definitely Low Risk of Bias (++)
• Direct evidence that the outcome was assessed using well-established methods (e.g., gold standard) • **AND** subjects had been followed for the same length of time in all study groups, • **AND** there is direct evidence that the outcome assessors (including study subjects, if outcomes were self-reported) were adequately blinded to the study group or exposure level, and it is unlikely that they could have broken the blinding prior to reporting outcomes. • **NOTE:** Well-established methods will depend on the outcome, but examples of such methods may include: diagnostic methods using commercial kits, commercial laboratories, or standard assays such as ELISAs with sufficiently low variation and limits of detection to allow discrimination between groups (or evidence that the assay could have detected a difference based on responses to a positive control).
Probably Low Risk of Bias (+)
• Indirect evidence that the outcome was assessed using acceptable methods (i.e., deemed valid and reliable but not the gold standard), • **AND** subjects had been followed for the same length of time in all study groups • **OR** it is deemed that the outcome assessment methods used would not appreciably bias results, • **AND** there is indirect evidence that the outcome assessors (including study subjects, if outcomes were self-reported) were adequately blinded to the study group, and it is unlikely that they could have broken the blinding prior to reporting outcomes, • **OR** it is deemed that lack of adequate blinding of outcome assessors would not appreciably bias results, which is more likely to apply to objective outcome measures, • **NOTE:** Acceptable, but not ideal assessment methods will depend on the outcome, but examples of such methods may include proxy reporting of outcomes and mining of data collected for other purposes.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the outcome assessment method is an insensitive instrument (e.g., a questionnaire used to assess outcomes with no information on validation), • **OR** the length of follow up differed by study group, • **OR** there is indirect evidence that it was possible for outcome assessors (including study subjects if outcomes were self-reported) to infer the study group prior to reporting outcomes, • **OR** there is insufficient information provided about blinding of outcome assessors (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the outcome assessment method is an insensitive instrument, • **OR** the length of follow up differed by study group, • **OR** there is direct evidence for lack of adequate blinding of outcome assessors (including study subjects if outcomes were self-reported), including no blinding or incomplete blinding.

10. Were all measured outcomes reported?

Definitely Low Risk of Bias (++)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported. This would include outcomes reported with sufficient detail to be included in meta-analysis or fully tabulated during data extraction and analyses had been planned in advance.
Probably Low Risk of Bias (+)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported, • **OR** analyses that had not been planned in advance (i.e., retrospective unplanned subgroup analyses) are clearly indicated as such and deemed that unplanned analyses were appropriate and selective reporting would not appreciably bias results (e.g., appropriate analyses of an unexpected effect). This would include outcomes reported with insufficient detail such as only reporting that results were statistically significant (or not).
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported, • **OR** and there is indirect evidence that unplanned analyses were included that may appreciably bias results, • **OR** there is insufficient information provided about selective outcome reporting (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported. In addition to not reporting outcomes, this would include reporting outcomes based on composite score without individual outcome components or outcomes reported using measurements, analysis methods or subsets of the data (e.g., subscales) that were not pre-specified or reporting outcomes not pre-specified, or that unplanned analyses were included that would appreciably bias results.

11. Were there no other potential threats to internal validity?

This question is used to address project-specific issues. We have identified the following risk-of-bias consideration for the BPA analogue literature "Did study control for cross-reactivity to other antigens (e.g. subjects with latex allergy may react to avocadoes and other fruits (Brehler *et al.* 1997))?

Definitely Low Risk of Bias (++)
• Direct evidence that the study controlled for potential cross-reactivity to other antigens.
Probably Low Risk of Bias (+)
• Indirect evidence that the study controlled for potential cross-reactivity to other antigens.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the study did not control for potential cross-reactivity to other antigens.
Definitely High Risk of Bias (--)
• Direct evidence that the study did not control for potential cross-reactivity to other antigens.

Case Control Studies

1. Was administered dose or exposure level adequately randomized? [NA]

2. Was allocation to study groups adequately concealed? [NA]

3. Did selection of study participants result in the appropriate comparison groups?

Definitely Low Risk of Bias (++)
• Direct evidence that cases and controls were similar (e.g., recruited from the same eligible population including being of similar age, gender, ethnicity, and eligibility criteria other than outcome of interest as appropriate), recruited within the same time frame, and controls are described as having no history of the outcome, • **Note:** A study will be considered low risk of bias if baseline characteristics of groups differed but these differences were considered as potential confounding or stratification variables (see question #4),
Probably Low Risk of Bias (+)
• Indirect evidence that cases and controls were similar (e.g., recruited from the same eligible population, recruited with the same method of ascertainment using the same inclusion and exclusion criteria, and were of similar age), recruited within the same time frame, and controls are described as having no history of the outcome, • **OR** it is deemed differences between cases and controls would not appreciably bias results.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that controls were drawn from a very dissimilar population than cases or recruited within very different time frames, • **OR** there is insufficient information provided about the appropriateness of controls including rate of response reported for cases only (record “NR” as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that controls were drawn from a very dissimilar population than cases or recruited within very different time frames.

4. Did study design or analysis account for important confounding and modifying variables?

Definitely Low Risk of Bias (++)
• Direct evidence that appropriate adjustments were made for the variables listed below as potential confounders and/or effect measure modifiers in the final analyses through the use of statistical models to reduce research-specific bias including standardization, matching of cases and controls, adjustment in multivariate model, stratification, propensity scoring, or other methods were appropriately justified, • **AND** there is direct evidence that primary covariates and confounders were assessed using valid and reliable measurements, • **AND** there is direct evidence that other exposures anticipated to bias results were not present or were appropriately measured and adjusted for. • The following variables may be considered as potential confounders and/or effect measure modifiers for the relationship between BPA analogue exposure and health outcomes: age, sex, race/ethnicity, body mass index, variables that represent socioeconomic status (e.g., educational level, household income), and the potential for occupational exposure to other chemicals.
Probably Low Risk of Bias (+)
• Indirect evidence that appropriate adjustments were made, • **OR** it is deemed that not considering or only considering a partial list of covariates or confounders in the final analyses would not appreciably bias results, • **AND** there is evidence (direct or indirect) that covariates and confounders considered were assessed using valid and reliable measurements, • **OR** it is deemed that the measures used would not appreciably bias results (i.e., the authors justified the validity of the measures from previously published research), • **AND** there is evidence (direct or indirect) that other co-exposures anticipated to bias results were not present or were appropriately adjusted for, • **OR** it is deemed that co-exposures present would not appreciably bias results. • **Note:** this includes insufficient information provided on co-exposures in general population studies.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the distribution of important covariates and known confounders differed between cases and controls and was not investigated further, • **OR** there is insufficient information provided about the distribution of known confounders in cases and controls (record “NR” as basis for answer), • **OR** there is indirect evidence that covariates and confounders considered were assessed using measurements of unknown validity, • **OR** there is insufficient information provided about the measurement techniques used to assess covariates and confounders considered (record “NR” as basis for answer), • **OR** there is indirect evidence that there was an unbalanced provision of additional co-exposures across cases and controls, which were not appropriately adjusted for, • **OR** there is insufficient information provided about co-exposures in occupational studies or studies of contaminated sites where high exposures to other chemical exposures would have been reasonably anticipated (record “NR” as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the distribution of important covariates and known confounders differed between cases and controls, confounding was demonstrated, but was not appropriately adjusted for in the final analyses, • **OR** there is direct evidence that covariates and confounders considered were assessed using non valid measurements, • **OR** there is direct evidence that there was an unbalanced provision of additional co-exposures across cases and controls, which were not appropriately adjusted for.

5. Were experimental conditions identical across study groups? [NA]

6. Were the research personnel blinded to the study group during the study? [NA]

7. Were outcome data complete without attrition or exclusion from analysis?

Definitely Low Risk of Bias (++)
• Direct evidence that exclusion of subjects from analyses was adequately addressed, and reasons were documented when subjects were removed from the study or excluded from analyses.
Probably Low Risk of Bias (+)
• Indirect evidence that exclusion of subjects from analyses was adequately addressed, and reasons were documented when subjects were removed from the study or excluded from analyses.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that exclusion of subjects from analyses was not adequately addressed, • **OR** there is insufficient information provided about why subjects were removed from the study or excluded from analyses (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that exclusion of subjects from analyses was not adequately addressed. • **Note**: Unacceptable handling of subject exclusion from analyses includes: reason for exclusion likely to be related to true outcome, with either imbalance in numbers or reasons for exclusion across study groups.

8. Can we be confident in the exposure characterization?

Definitely Low Risk of Bias (++)
• Direct evidence that exposure was consistently assessed (i.e., under the same method and time-frame) using well-established methods that directly measure exposure (e.g., measurement of BPA analogues in blood, serum, or plasma), • **OR** exposure was assessed using less-established methods that directly measure exposure and are validated against well-established methods. • **AND** exposure was assessed in a relevant time-window for development of the outcome, • **AND** there is sufficient range or variation in exposure measurements across groups to potentially identify associations with health outcomes, • **AND** there is evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished, • **AND** the study used spiked samples to confirm assay performance. • **Note:** Use of method blanks is necessary to identify potential sources of contamination in blood and urine but cannot rule out all possible sources of contamination (Ye *et al.* 2012).
Probably Low Risk of Bias (+)
• Indirect evidence that the exposure was consistently assessed using well-established methods that directly measure exposure), • **OR** exposure was assessed using indirect measures (e.g., drinking water levels and residency, questionnaire or occupational exposure assessment by a certified industrial hygienist) that have been validated or empirically shown to be consistent with methods that directly measure exposure (i.e., inter-methods validation: one method vs. another), • **AND** exposure was assessed in a relevant time-window for development of the outcome, • **AND** there is sufficient range or variation in exposure measurements across groups to potentially identify associations with health outcomes (at a minimum from high exposure or ever exposed from low exposure or never exposed), • **AND** there is evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished.

Probably High Risk of Bias (-) or (NR)
• Indirect evidence that exposure was assessed using poorly validated methods that directly measure exposure, • **OR** there is direct evidence that the exposure was assessed using indirect measures that have not been validated or empirically shown to be consistent with methods that directly measure exposure (e.g., a job-exposure matrix or self-report without validation) (record "NR" as basis for answer), • **OR** there is insufficient information provided about the exposure assessment, including validity and reliability, but no evidence for concern about the method used (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the exposure was assessed using methods with poor validity, • **OR** evidence of uncontrolled contamination, • **OR** evidence of exposure misclassification (e.g., differential recall of self-reported exposure).

9. Can we be confident in the outcome assessment?

Definitely Low Risk of Bias (++)
• Direct evidence that the outcome was assessed in cases (i.e., case definition) and controls using well-established methods (the gold standard), • **AND** subjects had been followed for the same length of time in all study groups, • **AND** there is direct evidence that the outcome assessors (including study subjects, if outcomes were self-reported) were adequately blinded to the exposure level when outcome was assessed in cases (i.e., case definition) and controls. • **NOTE** Well-established methods will depend on the outcome, but examples of such methods may include: diagnostic methods using commercial kits, commercial laboratories, or standard assays such as ELISAs with sufficiently low variation and limits of detection to allow discrimination between groups (or evidence that the assay could have detected a difference based on responses to a positive control)
Probably Low Risk of Bias (+)
• Indirect evidence that the outcome was assessed in cases (i.e., case definition) and controls using acceptable methods), • **AND** subjects had been followed for the same length of time in all study groups, • **OR** it is deemed that the outcome assessment methods used would not appreciably bias results, • **AND** there is indirect evidence that the outcome assessors were adequately blinded to the exposure level when reporting outcomes, • **OR** it is deemed that lack of adequate blinding of outcome assessors would not appreciably bias results (including that subjects self-reporting outcomes were likely not aware of reported links between the exposure and outcome or lack of blinding is unlikely to bias a particular outcome). • **NOTE** Acceptable, but not ideal assessment methods will depend on the outcome, but examples of such methods may include proxy reporting of outcomes such as asthma and mining of data collected for other purposes. Proxy reporting of immune disease should be considered on a case-by-case basis with consideration of whether or not there is empirical evidence as to the reliability of proxy reporting outcome.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the outcome was assessed in cases (i.e., case definition) using an insensitive instrument, • **OR** there is insufficient information provided about how cases were identified (record "NR" as basis for answer). • **OR** there is indirect evidence that it was possible for outcome assessors to infer the exposure level prior to reporting outcomes (including that subjects self-reporting outcomes were likely aware of reported links between the exposure and outcome), • **OR** there is insufficient information provided about blinding of outcome assessors (record "NR" as basis).
Definitely High Risk of Bias (--)
• Direct evidence that the outcome was assessed in cases (i.e., case definition) using an insensitive instrument, • **OR** there is direct evidence that outcome assessors were aware of the exposure level prior to reporting outcomes (including that subjects self-reporting outcomes were aware of reported links between the exposure and outcome).

10. Were all measured outcomes reported?

Definitely Low Risk of Bias (++)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported. This would include outcomes reported with sufficient detail to be included in meta-analysis or fully tabulated during data extraction and analyses had been planned in advance.
Probably Low Risk of Bias (+)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported, • **OR** analyses that had not been planned in advance (i.e., retrospective unplanned subgroup analyses) are clearly indicated as such and deemed that unplanned analyses were appropriate and selective reporting would not appreciably bias results (e.g., appropriate analyses of an unexpected effect). This would include outcomes reported with insufficient detail such as only reporting that results were statistically significant (or not).
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported, • **OR** and there is indirect evidence that unplanned analyses were included that may appreciably bias results, • **OR** there is insufficient information provided about selective outcome reporting (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported. In addition to not reporting outcomes, this would include reporting outcomes based on composite score without individual outcome components or outcomes reported using measurements, analysis methods or subsets of the data (e.g., subscales) that were not pre-specified or reporting outcomes not pre-specified, or that unplanned analyses were included that would appreciably bias results.

11. Were there no other potential threats to internal validity?

This question is used to address project-specific issues. We have identified the following risk-of-bias consideration for the BPA analogue literature "Did study control for cross-reactivity to other antigens (e.g. subjects with latex allergy may react to avocadoes and other fruits (Brehler *et al.* 1997))?

Definitely Low Risk of Bias (++)
• Direct evidence that the study controlled for potential cross-reactivity to other antigens.
Probably Low Risk of Bias (+)
• Indirect evidence that the study controlled for potential cross-reactivity to other antigens.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the study did not control for potential cross-reactivity to other antigens.
Definitely High Risk of Bias (--)
• Direct evidence that the study did not control for potential cross-reactivity to other antigens.

Experimental Animal Studies

1. Was administered dose or exposure level adequately randomized?

Definitely Low Risk of Bias (++)
• Direct evidence that animals were allocated to any study group including controls using a method with a random component, • **AND** there is direct evidence that the study used a concurrent control group as an indication that randomization covered all study groups, • **Note:** Acceptable methods of randomization include: referring to a random number table, using a computer random number generator, coin tossing, or shuffling cards (Higgins and Green 2011). • **Note:** Restricted randomization (e.g., blocked randomization) to ensure particular allocation ratios will be considered low bias. Similarly, stratified randomization approaches that attempt to minimize imbalance between groups on important prognostic factors (e.g., body weight) will be considered acceptable.
Probably Low Risk of Bias (+)
• Indirect evidence that animals were allocated to any study group including controls using a method with a random component (i.e., authors state random allocation, without description of method), • **AND** evidence that the study used a concurrent control group as an indication that randomization covered all study groups, • **OR** it is deemed that allocation without a clearly random component would not appreciably bias results.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that animals were allocated to study groups using a method with a non-random component, • **OR** indirect evidence that there was a lack of a concurrent control group, • **OR** there is insufficient information provided about how animals were allocated to study groups (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that animals were allocated to study groups using a non-random method including judgment of the investigator, the results of a laboratory test or a series of tests, • **OR** direct evidence that there was a lack of a concurrent control group.

2. Was allocation to study groups adequately concealed?

Definitely Low Risk of Bias (++)
• Direct evidence that at the time of assigning study groups the research personnel did not know what group animals were allocated to, and it is unlikely that they could have broken the blinding of allocation until after assignment was complete and irrevocable. • **Note:** Acceptable methods used to ensure allocation concealment include sequentially numbered treatment containers of identical appearance or equivalent methods.
Probably Low Risk of Bias (+)
• Indirect evidence that at the time of assigning study groups the research personnel did not know what group animals were allocated to and it is unlikely that they could have broken the blinding of allocation until after assignment was complete and irrevocable, • **OR** it is deemed that lack of adequate allocation concealment would not appreciably bias results.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that at the time of assigning study groups it was possible for the research personnel to know what group animals were allocated to, or it is likely that they could have broken the blinding of allocation before assignment was complete and irrevocable, • **OR** there is *insufficient* information provided about allocation to study groups (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that at the time of assigning study groups it was possible for the research personnel to know what group animals were allocated to, or it is likely that they could have broken the blinding of allocation before assignment was complete and irrevocable.

3. Did selection of study participants result in the appropriate comparison groups? [NA]

4. Did study design or analysis account for important confounding and modifying variables? [NA]

5. Were experimental conditions identical across study groups?

Definitely Low Risk of Bias (++)
• Direct evidence that same vehicle was used in control and experimental animals, • **AND** direct evidence that non-treatment-related experimental conditions were identical across study groups (i.e., the study report explicitly provides this level of detail).
Probably Low Risk of Bias (+)
• Indirect evidence that the same vehicle was used in control and experimental animals, • **OR** it is deemed that the vehicle used would not appreciably bias results, • **AND** identical non-treatment-related experimental conditions are assumed if authors did not report differences in housing or husbandry.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the vehicle differed between control and experimental animals, • **OR** authors did not report the vehicle used (record "NR" as basis for answer), • **OR** there is indirect evidence that non-treatment-related experimental conditions were not comparable between study groups.
Definitely High Risk of Bias (--)
• Direct evidence from the study report that control animals were untreated, or treated with a different vehicle than experimental animals, • **OR** there is direct evidence that non-treatment-related experimental conditions were not comparable between study groups.

6. Were the research personnel blinded to the study group during the study?

Definitely Low Risk of Bias (++)
• Direct evidence that the research personnel were adequately blinded to study group, and it is unlikely that they could have broken the blinding during the study. Methods used to ensure blinding include central allocation; sequentially numbered treatment containers of identical appearance; sequentially numbered animal cages; or equivalent methods,
Probably Low Risk of Bias (+)
• Indirect evidence that the research personnel were adequately blinded to study group, and it is unlikely that they could have broken the blinding during the study, • **OR** it is deemed that lack of adequate blinding during the study would not appreciably bias results. This would include cases where blinding was not possible but research personnel took steps to minimize potential bias, such as restricting the knowledge of study group to veterinary or supervisory personnel monitoring for overt toxicity, or randomized husbandry or handling practices (e.g., placement in the animal room, necropsy order, etc.).
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the research personnel were not adequately blinded to study group, • **OR** there is insufficient information provided about blinding to study group during the study (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the research personnel were not adequately blinded to study group.

7. Were outcome data complete without attrition or exclusion from analysis?

Definitely Low Risk of Bias (++)
• Direct evidence that loss of animals was adequately addressed and reasons were documented when animals were removed from a study. • **Note**: Acceptable handling of attrition includes: very little missing outcome data; reasons for missing animals unlikely to be related to outcome (or for survival data, censoring unlikely to be introducing bias); missing outcome data balanced in numbers across study groups, with similar reasons for missing data across groups; missing outcomes is not enough to impact the effect estimate. • **OR** missing data have been imputed using appropriate methods (insuring that characteristics of animals are not significantly different from animals retained in the analysis).
Probably Low Risk of Bias (+)
• Indirect evidence that loss of animals was adequately addressed and reasons were documented when animals were removed from a study, • **OR** it is deemed that the proportion lost would not appreciably bias results. This would include reports of no statistical differences in characteristics of animals removed from the study from those remaining in the study.
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that loss of animals was unacceptably large and not adequately addressed, • **OR** there is insufficient information provided about loss of animals (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that loss of animals was unacceptably large and not adequately addressed. • **Note**: Unacceptable handling of attrition or exclusion includes: reason for loss is likely to be related to true outcome, with either imbalance in numbers or reasons for loss across study groups.

8. Can we be confident in the exposure characterization?

Definitely Low Risk of Bias (++)
• Direct evidence that the exposure to any of the BPA analouges was independently characterized and purity confirmed generally as ≥98%, (and compliance with the treatment, if applicable) • **AND** that exposure was consistently administered (i.e., with the same method and time-frame) across treatment groups, • **AND** for dietary or drinking water studies that information is provided on consumption or internal dose metrics to confirm expected exposure levels sufficiently to allow discrimination between exposure groups, • **AND** if internal dose metrics are available, there is evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished, • **AND** if internal dose metrics are available, the study used spiked samples to confirm assay performance. • **Note:** Use of method blanks is necessary to identify potential sources of contamination in blood and urine but cannot rule out all possible sources of contamination (Ye *et al.* 2012). • **Note:** Important soureces of contamination may include animal housing and food and water delivery systems.
Probably Low Risk of Bias (+)
• Indirect evidence that the exposure to any of the BPA analogues was appropriately characterized and purity confirmed generally as ≥98% (i.e., the supplier of the chemical provides documentation of the purity of the chemical), • **OR** direct evidence that purity was independently confirmed as ≥95% and it is deemed that impurities of up to 5% would not appreciably bias results, • **AND** that exposure was consistently administered (i.e., with the same method and time-frame) across treatment groups, • **AND** for dietary or drinking water studies no information is provided on consumption or internal dose metrics, • **AND** if internal dose metrics are available, there is indirect evidence that most of the exposure data measurements are above the limit of quantitation for the assay such that different exposure groups can be distinguished.

Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the exposure (including purity of the test substance and compliance with the treatment, if applicable) was assessed using poorly validated methods, • **OR** there is insufficient information provided about the validity of the exposure assessment method, but no evidence for concern (record "NR" as basis for answer), • **AND** if internal dose metrics are available, there is indirect evidence that most of the exposure data measurements are below the limit of quantitation for the assay such that different exposure groups cannot be distinguished.
Definitely High Risk of Bias (--)
• Direct evidence that the exposure (including purity of the test substance and compliance with the treatment, if applicable) was assessed using poorly validated methods, • **AND** if internal dose metrics are available, there is direct evidence of uncontrolled contamination.

9. Can we be confident in the outcome assessment?

Definitely Low Risk of Bias (++)
• Direct evidence that the outcome was assessed using well-established methods (e.g., gold standard) • **AND** assessed at the same length of time after initial exposure in all study groups, • **AND** there is direct evidence that the outcome assessors were adequately blinded to the study group, and it is unlikely that they could have broken the blinding prior to reporting outcomes. • **NOTE** Well-established methods will depend on the outcome, but examples of such methods may include: objectively measured antibody or cytokine concentrations with diagnostic methods using commercial kits, commercial laboratories with experience in the assay, or standard assays such as ELISAs for IgG and with sufficiently low variation and limits of detection to allow discrimination of responses between treatment groups (or direct evidence that the assay could have detected a difference based on responses to a positive control).
Probably Low Risk of Bias (+)
• Indirect evidence that the outcome was assessed using acceptable methods (i.e., deemed valid and reliable but not the gold standard), • **AND** assessed at the same length of time after initial exposure in all study groups, • **OR** it is deemed that the outcome assessment methods used would not appreciably bias results, • **AND** there is indirect evidence that the outcome assessors were adequately blinded to the study group, and it is unlikely that they could have broken the blinding prior to reporting outcomes, • **OR** it is deemed that lack of adequate blinding of outcome assessors would not appreciably bias results, which is more likely to apply to objective outcome measures. • **NOTE** For some outcomes, particularly histopathology assessment, outcome assessors are not blind to study group as they require comparison to the control to appropriately judge the outcome, but additional measures such as multiple levels of independent review by trained pathologists can minimize potential bias. • **NOTE** Acceptable assessment methods will depend on the outcome, but examples of such methods may include: objectively measured antibody or cytokine concentrations with diagnostic methods using commercial kits with some variation, but ability to discriminate between the high dose treatment and control group (or indirect evidence that the assay could have detected a difference based on responses to a positive control).

Probably High Risk of Bias (-) or (NR)
• Indirect evidence that the outcome assessment method is an insensitive instrument, • **OR** the length of time after initial exposure differed by study group, • **OR** there is indirect evidence that it was possible for outcome assessors to infer the study group prior to reporting outcomes without sufficient quality control measures, • **OR** there is insufficient information provided about blinding of outcome assessors (record "NR" as basis for answer).
Definitely High Risk of Bias (--)
• Direct evidence that the outcome assessment method is an insensitive instrument, • **OR** the length of time after initial exposure differed by study group, • **OR** there is direct evidence for lack of adequate blinding of outcome assessors, including no blinding or incomplete blinding without quality control measures.

10. Were all measured outcomes reported?

Definitely Low Risk of Bias (++)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported. This would include outcomes reported with sufficient detail to be included in meta-analysis or fully tabulated during data extraction and analyses had been planned in advance.
Probably Low Risk of Bias (+)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have been reported, • **OR** analyses that had not been planned in advance (i.e., retrospective unplanned subgroup analyses) are clearly indicated as such and deemed that unplanned analyses were appropriate and selective reporting would not appreciably bias results (e.g., appropriate analyses of an unexpected effect). This would include outcomes reported with insufficient detail such as only reporting that results were statistically significant (or not).
Probably High Risk of Bias (-) or (NR)
• Indirect evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported, • **OR** and there is indirect evidence that unplanned analyses were included that may appreciably bias results, • **OR** there is insufficient information provided about selective outcome reporting (record "NR" as answer basis).
Definitely High Risk of Bias (--)
• Direct evidence that all of the study's measured outcomes (primary and secondary) outlined in the protocol, methods, abstract, and/or introduction (that are relevant for the evaluation) have not been reported. In addition to not reporting outcomes, this would include reporting outcomes based on composite score without individual outcome components or outcomes reported using measurements, analysis methods or subsets of the data (e.g., subscales) that were not pre-specified or reporting outcomes not pre-specified, or that unplanned analyses were included that would appreciably bias results.

11. Were there no other potential threats to internal validity?

There are no BPA analogue-specific additions to the risk-of-bias questions for this evaluation. This question will be used to examine individual studies for appropriate statistical methods (e.g., confirmation of homogeneity of variance for ANOVA and other statistical tests that require normally distributed data). It will also be used for risk-of-bias considerations that do not fit under the other questions.