



Process Description for Identification, Review, and Categorization of Scientific Literature Concerning Glyphosate and AMPA Side-Effects on Health, the Environment, and Non-Target Species

1. Databases Considered

The technical literature databases considered in identifying relevant technical literature are summarized in Table 1. The search process includes 5 distinct databases; some publications are identified by multiple databases. These databases are believed to provide comprehensive coverage for peer-reviewed technical literature for glyphosate and AMPA.

Table 1. Technical Databases used for glyphosate and AMPA literature search

Database	Description
<p>Web of ScienceSM</p> <p><u>Accessed through:</u> Web of Knowledge (Thompson Reuters) http://isiknowledge.com/</p>	<ul style="list-style-type: none"> • <u>Science Citation Index Expanded:</u> A multidisciplinary index to the journal literature of the sciences. It fully indexes over 6,650 major journals across 150 scientific disciplines and includes all cited references captured from indexed articles. (1995 – present) • <u>Conference Proceedings Citation Index- Science.</u> This citation index covers conference literature in all scientific and technical fields, including: Agriculture, Biochemistry, Biology, Biotechnology,, Chemistry, , Computer Science , Engineering, Environmental Sciences, Medicine, Physics. (1990-present) <p>Reference: http://thomsonreuters.com/products_services/science/science_products/a-z/web_of_science/</p>
<p>BIOSIS Previews®</p> <p><u>Accessed through:</u> Web of Knowledge (Thompson Reuters) http://isiknowledge.com/</p>	<p>(1969 – present)</p> <ul style="list-style-type: none"> • Life sciences and biomedical research covering pre-clinical and experimental research, methods and instrumentation, animal studies, and more. • BIOSIS Previews combines journal content from Biological Abstracts® with supplemental, non-journal coverage from Biological Abstracts/RRM® (Reports, Reviews, Meetings).. • Includes CAS Registry Number searching <p>Reference: http://thomsonreuters.com/products_services/science/science_products/a-z/biosis_previews/</p>
<p>CAB Abstracts® (CABI)</p> <p><u>Accessed through:</u> Web of Knowledge (Thompson Reuters) http://isiknowledge.com/</p>	<p>(1973 – present)</p> <ul style="list-style-type: none"> • Provides authoritative research information on agriculture, environment and related applied life sciences. • Includes CAS Registry Number searching • Explore data from journals, books, proceedings, monographs, technical reports, and more <p>Reference: http://www.cabi.org/default.aspx?site=170&page=1016&pid=125</p>
<p>MEDLINE®</p> <p><u>Accessed through:</u> Web of Knowledge (Thompson Reuters) http://isiknowledge.com/</p>	<p>(1950 – present)</p> <ul style="list-style-type: none"> • The U.S. National Library of Medicine® (NLM®) premier life sciences database. • Includes biomedicine and life sciences, bioengineering, public health, clinical care, and plant and animal science • Search precisely with CAS registry numbers; link to NCBI databases and PubMed Related Articles <p>Reference: http://www.nlm.nih.gov/pubs/factsheets/medline.html</p>



Database	Description
CA Plus (Chemical Abstracts Plus) <u>Accessed through:</u> CAS (Chemical Abstracts Service) (via SciFinder)	<ul style="list-style-type: none"> Worldwide coverage of many scientific disciplines in one source An integrated source of journal articles, patent documents, dissertations, meeting abstracts and other reputable web sources in many scientific disciplines, including biomedical sciences, chemistry, engineering, materials science, agricultural science and more English language summaries translated from the scientific literature published in more than 50 different languages from more than 180 different countries Updated daily References: http://www.cas.org/expertise/cascontent/caplus/ , http://www.cas.org/products/scifindr/

2. Search Criteria

The following search criteria are used for all five databases listed in Table 1.

glyphosat* OR glifosat* OR glyfosat* OR 1071-83-6 OR 38641-94-0 OR 70901-12-1 OR 39600-42-5 OR 69200-57-3 OR 34494-04-7 OR 114370-14-8 OR 40465-66-5 OR 69254-40-6 OR (aminomethyl w phosphonic*) OR 1066-51-9

Table 2 provides the definition for each CAS (Chemical Abstract Service) numbers listed. The search was not limited by topic (e.g. toxicology, environmental fate). Instead, a broad search was conducted, and the search results were then reviewed and classified. The glyphosate salts included (by CAS number) in the search represent the range of salts potentially present in commercial glyphosate formulations. It is possible that additional salts or glyphosate complexes could be discussed in publications, but they would not be considered relevant for the purposes discussed in this document.

Table 2. Search terms used in the technical literature search for glyphosate and AMPA

Compound	Search term	Description ^a
Glyphosate	glyphosat*	Text for identifying where the CAS number may not be properly attributed (“*” is a wildcard character)
	glifosat*	
	glyfosat*	
Glyphosate acid	1071-83-6	Glycine, N-(phosphonomethyl)-
Glyphosate, isopropylamine salt	38641-94-0	Glycine, N-(phosphonomethyl)-, compd. with 2-propanamine (1:1)
Glyphosate, potassium salt	70901-12-1	Glycine, N-(phosphonomethyl)-, potassium salt (1:?)
	39600-42-5	Glycine, N-(phosphonomethyl)-, potassium salt (1:1)
	69200-57-3	Glycine, N-(phosphonomethyl)-, potassium salt (1:2)
Glyphosate, ammonium salt	114370-14-8	Glycine, N-(phosphonomethyl)-, ammonium salt (1:?)
	40465-66-5	Glycine, N-(phosphonomethyl)-, ammonium salt (1:1)
	69254-40-6	Glycine, N-(phosphonomethyl)-, ammonium salt (1:2)
Glyphosate, methylmethanamine salt	34494-04-7	Glycine, N-(phosphonomethyl)-, compd. with N-methylmethanamine (1:1)
AMPA (aminomethylphosphonic acid)	aminomethyl w phosphonic*	Text for identifying records where the CAS number may not be properly attributed (“*” is a wildcard character; “w” is a proximity operator to specify that “aminomethyl” must be adjacent to “phosphonic”)
	1066-51-9	Phosphonic acid, (aminomethyl)-

^a Chemical name is as specified in the Chemical Abstracts Registry system, accessed via SciFinder.

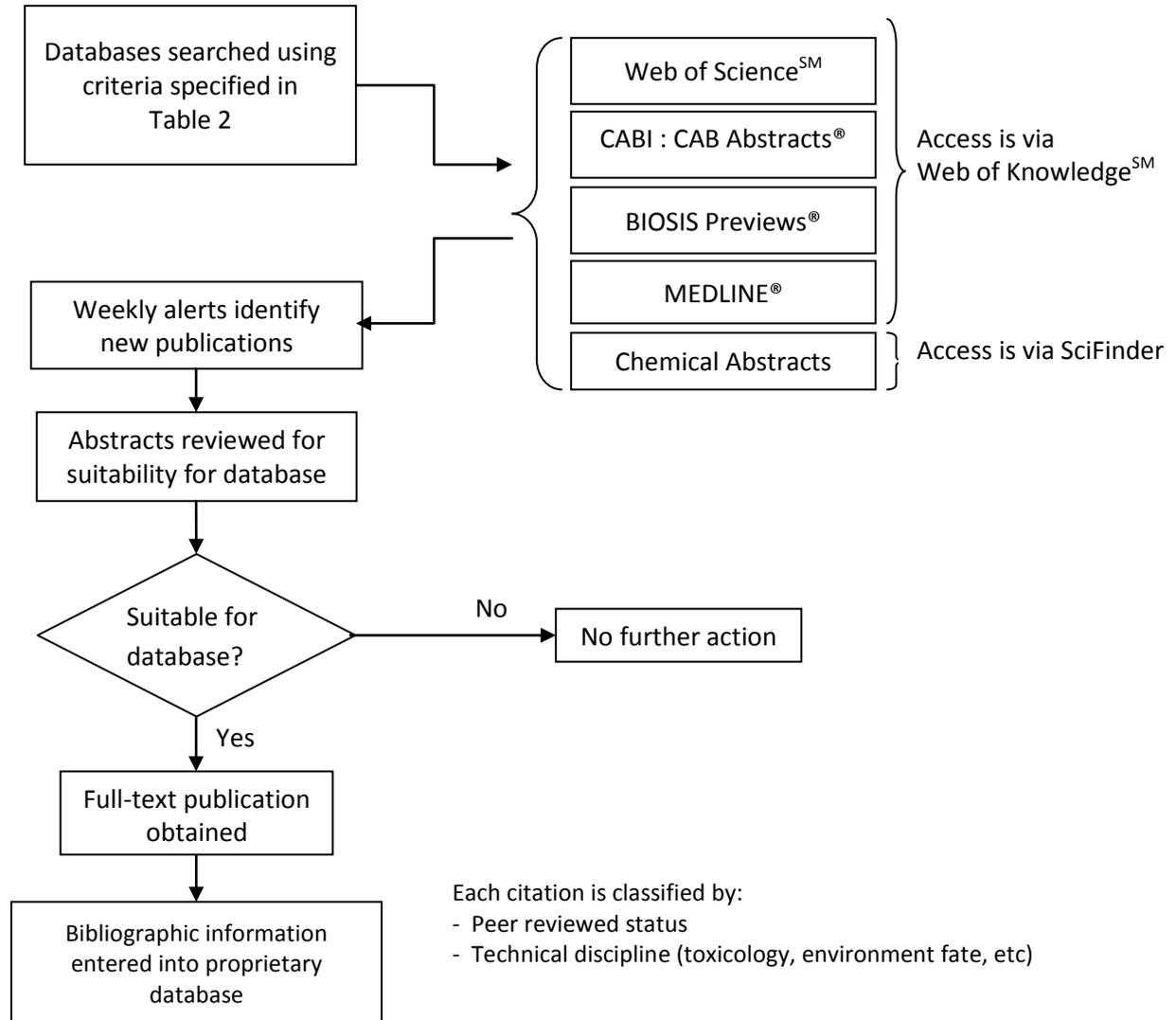
Note: Searches based on these search terms will also identify publications that consider glyphosate and surfactants (such as polyoxyethylenealkylamines, or POEA), in the context of glyphosate formulations..



3. Literature Search Process

An overview of the current search process is depicted in Figure 1. The outlined process reflects a comprehensive search methodology, utilizing five databases that are available through subscription or license agreements with the database providers.

Figure 1. Process for identification of technical publications about glyphosate and AMPA effects





4. Evaluation of Search Results

The focus of the literature surveillance effort was to identify publications that describe fate, characterization, or unintended effects of glyphosate or AMPA. A “suitable” publication is one that was identified as containing this type of information, and there was value in capturing the citation in the database.

- Unintended effects include the impact of glyphosate or AMPA on any organism that is not a target organism, including non-target plants, birds, mammals, fish, amphibians, insects, soil macro- or micro- organisms, other terrestrial or aquatic invertebrates, humans, or the environment. “Environment” includes (but is not limited to) water (groundwater, surface water, rainwater), air, soil, and sediment.
- Fate and characterization includes (for example) movement from treated areas, metabolism in plants, degradation in soil, analytical methods, residues in food items, and interactions of an active ingredient with environmental components (e.g. glyphosate-metal interactions).
- Publications of all types were considered in this analysis, regardless of peer-review status. Examples of non-peer-reviewed items that were identified include academic dissertations, conference proceedings, meeting abstracts, posters, academic bulletins, letters to the editor, and internet publications. On occasion, government reports or publications were included, particularly if it was considered useful to have the publications in a central location.
- An effort was made to limit the contents of the database to items that were accessible by the public; proprietary information was not included in the database.

Listed below are several examples to illustrate the type of publications that were reviewed, and how different topics were evaluated. Generally, the article abstract was used to assess suitability for the database; the full-text article may also be reviewed at this step.

- Examples of publication topics that were included in (were suitable for) the database:
 - Effects of glyphosate on sensitive plants outside a field due to spray drift
 - Monitoring or modeling of glyphosate or AMPA in surface waters
 - Effects of products containing glyphosate on tropical fish
 - Impact of glyphosate herbicides on plant disease or soil properties
- Examples of publication topics that were not generally included in the database:¹
 - Publications where the discussion is limited to the intended effects of the product (e.g. efficacy, weed control, vegetation management, crop yield related to weed control).
 - Publications that cite a secondary article, where glyphosate is in the cited article title, but there is no other mention of glyphosate in the publication text.
 - Publications where the only mention of glyphosate is about the use prior to a field experiment that is unrelated to the glyphosate use.

The articles selected for inclusion in the database were assigned to one or more general disciplines depending on the subject matter of the article. These disciplines included: toxicology, ecotoxicology, environmental fate, residues, analytical methods, efficacy, and GM crops.

¹ On occasion, publications of these types were included in the database, usually when the abstract suggested that the article was suitable. If the full-text version of the publication had been purchased, then the citation was included in the database, to facilitate access to the article (even if glyphosate was only briefly mentioned).



5. Overview of Database Content (2001 – 2011)

For the publication years of 2001 through 2011, there were 2,770 citations regarding glyphosate and/or AMPA that were added to the database. Full-text versions of these citations were obtained and archived (there are a few items from foreign journal where only the abstract was available).

Table 3 lists the number of publications in the database, organized by publication year and peer-review status. The numeric data are depicted graphically in Figure 2.

Table 4 lists the number of publications in the database in the technical disciplines relevant to the submission. Since a single publication may contain content related to multiple technical disciplines, the sum of the discipline totals in Table 4 is greater than the number of publications.

Table 3. Number of identified glyphosate/AMPA publications by publication year and peer-review status (depicted in Figure 2)

Publication Year	Peer-Reviewed?		Total
	Yes	No (or unknown)	
2001	145	72	217
2002	157	58	215
2003	202	75	277
2004	181	58	239
2005	215	20	235
2006	155	24	179
2007	162	38	200
2008	229	57	286
2009	249	45	294
2010	247	50	297
2011	286	45	331
Total (2001 – 2011)	2,228	542	2,770

Note: Values represent the database content at the end of December 2011, and include publications in disciplines not relevant to submission (e.g., efficacy).



Figure 2. Distribution of total glyphosate/AMPA publications in proprietary database (2001 – 2011) by peer-review status.

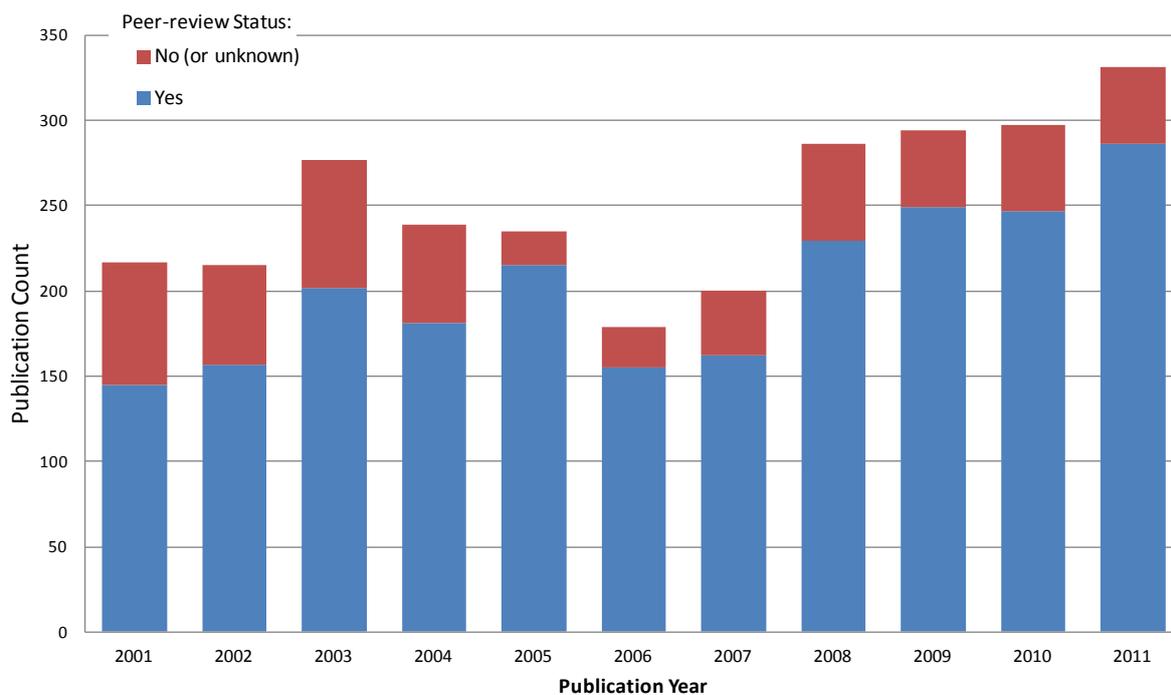


Table 4. Number of peer-reviewed glyphosate/AMPA publications in the proprietary database, by technical discipline (2001-2011)

Technical Discipline	Number of Publications in Proprietary Database
Ecotoxicology	662
Environmental Fate	973
Toxicology	435
Residues	43

Note: Some publications are assigned to more than one technical discipline. Values represent the proprietary database content at the end of December 2011.



6. Categorization of Publications

The peer-reviewed publications were divided into the four key disciplines within the submission that address exposure and hazard (toxicology, ecotoxicology, residues and environmental fate). Some publications contained information relevant to more than one technical discipline. In some cases, the disciplines originally assigned during the search process were revised to match the disciplines within the submission (for example, publications on effects of glyphosate on soil microorganisms were classified as 'environmental fate' in the original literature search but were reclassified as 'ecotoxicology' for the submission).

The peer-reviewed publications identified for inclusion during the literature search were reviewed within each discipline and classified into one of the categories listed below.

- **Category 0 publications:** These are publications in which glyphosate is only mentioned as an example substance or is discussed/studied in a context that is not relevant or related to any of the regulatory sections or the exposure/hazard assessments within this submission.
- **Category 1 publications:** These are publications that discuss glyphosate in a context relevant or related to the regulatory dossier sections and the conclusions fall within the conclusions of the exposure/hazard assessment.
- **Category 2 publications:** These are publications that discuss glyphosate in a context relevant or related to the regulatory dossier sections and have conclusions that call into question the endpoints/conclusions in the exposure/hazard assessment. Additionally, Category 2 also includes publications with conclusions that support the risk/hazard assessment, and may be included in discussion of other relevant publications.
- **Category 3 publications:** These are publications that discuss glyphosate in a context relevant or related to (1) non-regulatory endpoints that need to be addressed as per new Regulation (EC) 1107/2009; (2) sensitive allegations that have emerged or could emerge in the media; or (3) the regulatory dossier sections and have conclusions that are in disagreement with endpoints/conclusions in the exposure/hazard assessment (although the experimental design seems relevant at first glance).



7. Overview of Peer-Reviewed Publications (2001-2011)

Of the approximately 2000 publications evaluated, approximately 1000 were assigned a Category 0 and are not included in the submission. The separation of the remaining publications by discipline and category is summarized in Table 5, and shown in Figure 3.

Table 5. Number of peer-reviewed glyphosate/AMPA publications selected for inclusion in submission, by discipline and category (depicted in Figure 3)

Technical Discipline	Total Number of Publications Included in Submission	Number of Publications, by Category		
		Category 1	Category 2	Category 3
Ecotoxicology	478	295	111	72
Environmental Fate	305	228	67	10
Residues	20	19	1	--
Toxicology	275	179	51	45
Totals	1031	692	223	125

Table Notes:

- Some publications are assigned to more than one technical discipline, and the category classification may differ by discipline for the same publication.

Figure 3. Distribution of peer-reviewed glyphosate/AMPA publications identified, by discipline and category.

