

## CHAPTER 3.0

# LITERATURE SEARCH AND REVIEW

### 3.1 Introduction

We used a systematic process to identify, obtain, and review current literature on wastewater collection system odor and corrosion. First, we developed protocols for searching the published technical literature, unpublished documents (“gray literature”) containing public and private organizations’ information and experience, and literature included in previous WERF studies. Second, the references we obtained following the search protocol were compiled and screened for inclusion. After these papers were acquired, we cataloged and distributed them by topic category to project team experts for review. Finally, team members’ literature reviews were completed and essential information about each paper recorded electronically. The literature search and review process was comprehensive and thorough and resulted in an annotated library of current literature relevant to the project topic.

### 3.2 Published Literature Search Protocol

The plan for conducting the published literature search consisted of identifying keywords and databases and dividing members into search teams. Project team members generated a comprehensive list of keywords (see Appendix A) covering each of 14 major topic categories within the broader topic of wastewater collection odor and corrosion. Those keywords were sorted into four major topic groups in order to share the work of carrying out the search. The topic groups and search teams were organized as follows:

- Group 1, Jeff Weis and Los Angeles County Sanitation District (LACSD), searched collection system components and corrosion.
- Group 2, Shabbir Basrai and Orange County Sanitation District (OCSD), searched containment, ventilation, and gas phase treatment.
- Group 3, Dr. Richard Stuetz of the University of New South Wales and Joseph Cesca of CH2M HILL, searched liquid phase and biological treatment.
- Group 4, Dr. Richard Corsi of the University of Texas at Austin and Matthew Ward of CH2M HILL, searched emissions modeling and compounds.

The rationale for dividing the search was that different teams would have different resources; the teams could focus their efforts, minimize duplication of effort, and thereby explore

more deeply the available literature abstracts. Some redundancy was built in to the process: published papers missed by one group could be caught by another. Each group searched a different set of keywords, but flagged all papers related to any relevant project topic. Some overlap occurred without causing unwarranted duplication of effort.

All English-language papers published during or later than 2000 were included. However, the search built on a previous WERF study that included a systematic search of papers published from 1990 to 2000 (with discretionary inclusion of earlier papers). Other papers published before 2000 were included at the discretion of each search team based on relevance to the research topic. A core list of bibliographic databases and search tools was selected according to the experience of the academic project team members. The selected databases were chosen to provide comprehensive coverage of English-language technical literature related to the project topic. A University of Texas reference librarian was consulted to verify that the most appropriate databases were chosen. In addition to the core databases, supplementary databases were used at the discretion of each search team. Table 3-1 lists the databases used.

Group	Published Literature Search Tool
Core (all groups)	Academic Search Premier Chemical Abstracts Engineering Index (Compendex) Dissertation Abstracts
Supplementary Group 1	Environmental Engineering Abstracts Civil Engineering Abstracts Pollution Abstracts Corrosion Abstracts Wilson Applied Science and Technology Abstracts
Supplementary Group 2	Applied Science full text
Supplementary Group 3	GEOBASE MEDLINE CAplus MEDLINE CAS REGISTRY CASREACT Proquest Science Journals Civil Engineering Database Proquest Digital Dissertation Database Science Citation Index Expanded Applied Science and Technology Abstracts
Supplementary Group 4	Science Citation Index Expanded

A three-pronged quality assurance/quality control (QA/QC) plan was adopted to prevent important published literature from being overlooked. First, the search teams queried alternative databases and indexes in order to find papers not identified by the core databases. Second, during the search process a database of included papers was maintained and made available to all project team members. Each project team member identified, on the basis of professional experience, important literature missed by the keyword search. Third, Google Scholar, a broad, multidisciplinary academic search engine, was queried to pick up any papers that had been missed through the other search methods. For the Google Scholar search, a less restrictive keyword search string was employed in order to identify all papers related to any of the topic categories.

### 3.3 Gray Literature Search Protocol

So that the project could benefit from public utilities' and private vendors' knowledge and experience, unpublished, or gray, literature was solicited from an extensive list of public and private organizations. One hundred forty-nine public utilities were sent a formal request for gray literature. The letter sent to each utility requested a list of studies and technical papers, owned by the utility, of potential interest to the project. Upon receiving lists from responding utilities, the team requested that specific items from each list be sent in electronic or hard copy form. As a follow-up to the gray literature solicitation letter, certain key organizations were contacted by phone to request their participation. Appendix B contains the gray literature solicitation letter and list of contacted utilities.

Project team members generated a list of vendors and private companies known to have experience in wastewater collection odor and corrosion. Each company on the list was contacted by telephone and asked to participate by submitting technical papers for inclusion in the project. Appendix C contains a list vendors contacted.

### 3.4 Previous WERF Literature Search Protocol

In order to consolidate information generated from a previous, related project and combine it with this project, literature from WERF's (2003) literature search and review was screened for relevance to this study; any papers from it that were related to collection systems were included here. The previous study included gray and published literature generated prior to 2000.

### 3.5 Search Results

References generated by the search processes were compiled and screened for inclusion. The first step in the screening process was to eliminate duplicate references, which composed perhaps 50 percent of the search hits. Next, references with titles obviously unrelated to the topic were eliminated. Abstracts of remaining references were reviewed for relevance. In general, all papers with direct relevance to wastewater collection odor and corrosion were included; also included were some papers with indirect relevance, including those related to the following:

- Treatment plants that had some discussion of processes upstream of the headworks
- Technologies for controlling odors generated in locations other than collection systems that might be applied to collection systems
- Collection system odor and corrosion as one among several topics

The published literature search generated 2,945 references, of which 263 were worth including. These papers were mostly conference proceedings, journal articles, and theses published in 2000 or later. Books were used to identify important primary sources and as references for individual authors, but books were not themselves included in the formal review process because books on this topic area usually provide a secondary compilation of work published in technical journals.

The gray literature search generated 52 papers from nine organizations. Of these, 33 contained information relevant to the project and were included in the system. From the previous WERF study, 317 papers were screened (published and gray), and 85 were included. The QA/QC process generated an additional 45 papers identified by project team members. The Google Scholar search produced 485 references, 14 of which were worth including and had not

yet been identified. The total number of references screened was 3,843; 436 total papers were included. Nineteen of the papers turned out to be foreign language papers, and four could not be obtained. Thus the total number of papers submitted to the review process was 413. Table 3-2 summarizes these results.

**Table 3-2. Literature Search Results Statistics**

Source	Number Submitted	Number Included
US Filter	3	3
Carus Chemical	5	0
Premier Chemical	15	6
LACSD	11	11
OCSD	4	4
City of Tacoma	2	2
Onodaga County	3	3
Ortec	6	3
Byogon	3	1
Previous WERF studies	317	85
Group 1 (Weiss) search	1,284	—
Group 2 (Basrai) search	672	—
Group 3 (Stuetz) search	634	—
Group 4 (Ward) search	355	—
Published literature subtotal	2,945	259
Identified by team members	45	45
Google Scholar search	485	14
Subtotal	3,842	436
Less those in a foreign language	—	19
Less those that could not be found	—	4
Total reviewed	—	413

Figure 3-1 summarizes the included literature in terms of percentage from each source.

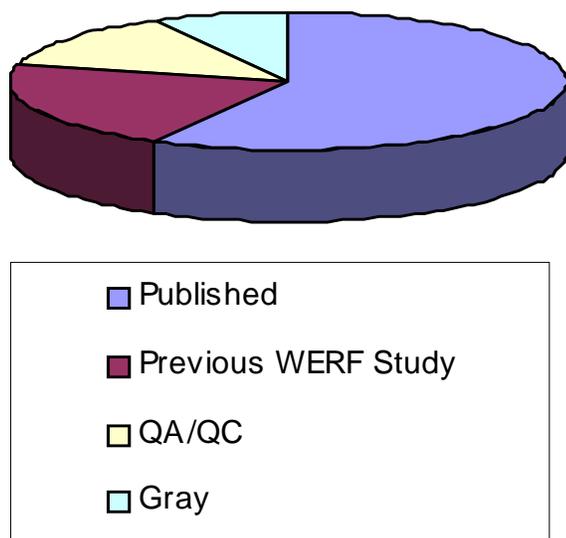


Figure 3-1. Distribution of Included Literature from Each Source

Figure 3-2 summarizes the included literature in terms of percentage of each type.

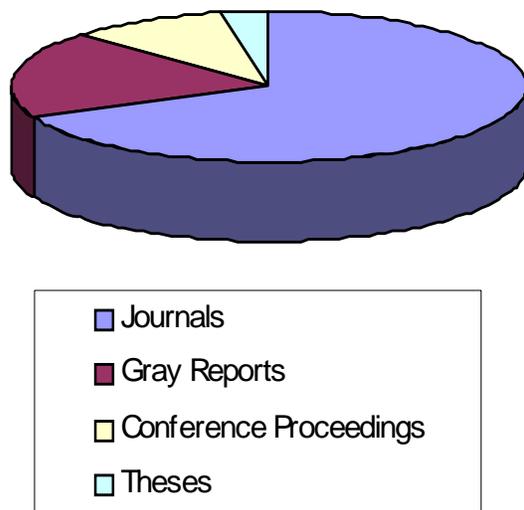


Figure 3-2. Distribution of Each Type of Included Literature

All references were compiled and managed as Endnote files. Endnote is a software application designed to import, export, and manipulate bibliographic data. This format has features that may become useful later, in project phase II, during which a computer-based tool will be developed. Additionally, all references identified for inclusion were maintained in an Excel spreadsheet, which was posted on the project team website. Each reference identified for inclusion was assigned a unique identification number so that papers could be tracked without confusion due to nonunique bibliographic data.

### 3.6 Literature Acquisition and Management

A complete copy of each included reference was sought using one of five methods. All papers that could be obtained through library online journal subscriptions were obtained first. Papers not available through online journals were sought through other internet sources. Papers not available online were sought in hard copy form from several university libraries. All remaining references were requested through the interlibrary loan service of the University of Texas at Austin. Papers not available from a library were sought from project team members.

Each paper was converted to PDF and posted to the project website. A library containing paper copies of each paper was also created. Each paper was assigned, according to topic category, to one of nine primary authors. Table 3-3 lists each author along with his assigned topic categories.

Primary authors downloaded their assigned papers, reviewed them, and filled out a review form for each. Review forms were then copied into the Excel database. The review form contained fields for reference data, a summary topic statement, a quality rating, important conclusions, and identified research data gaps, and was structured to capture a paper's essential information and guide the author in composing the Phase I report. Information in the review form could also form the basis for a searchable database of information on each paper. Appendix D contains a copy of the review form.

Table 3-3. Phase I Report Primary Authors and Topic Categories

Primary Author	Topic Category
Jay Witherspoon	Introduction and preliminary summary
James Joyce	Plain English guidance manual
	Sewer system overview and issues related to major collection system components
Richard Corsi & Richard Stuetz	Odor and corrosion compound generation and measurement
Chris Quigley	Physical, chemical, and biological transformation processes in collection systems
Steve Davidson	Collection system emissions and emissions modeling
Chris Easter & Matthew Ward	Collection System Ventilation approaches to reducing odors and corrosion in collection systems
Robert Bowker	Liquid phase chemical treatment and liquid phase biological and enzyme treatment
Philip Wolstenholme	Gas phase treatment
Chris Easter	Corrosion and corrosion protection
	Summary of research data gaps identified during the phase 1 literature search

Identifying topics worthy of further research was a primary purpose of the literature review process and will form the basis for later project phases.

### 3.7 Literature Search and Review Conclusions

Overall, the literature search and review process was systematic, thorough, and efficient. Peer-reviewed journal articles represented the bulk of new literature, indicating high-quality advances in the topic area. New academic theses were relatively few, indicating limited emergent interest in the topic area among graduating scholars. The review process resulted in a comprehensive database of substantive commentary on each source. This will form the framework for a useful CD-ROM-based research tool, which can help to advance the quality of engineering practice in the area of wastewater collection system odor and corrosion.