

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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The Sherwin-Williams Company  
Petitioner

v.

Arch Chemicals, Inc.  
Patent Owner

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Case No. IPR2019-01497  
Case No. IPR2019-01498  
Patent 9,723,842

Case No. IPR2019-01499  
Patent 9,717,250

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**DECLARATION OF SYLVIA D. HALL-ELLIS, PH.D.**

## **I. INTRODUCTION**

1. My name is Sylvia D. Hall-Ellis. I have been retained as an expert by The Sherwin-Williams Company (“Sherwin-Williams”).

2. I have written this report at the request of Sherwin-Williams to provide my expert opinion regarding the authenticity and public availability of a book. My report sets forth my opinions in detail and provides the basis for my opinions regarding the public availability of these publications.

3. I reserve the right to supplement or amend my opinions, and bases for them, in response any additional evidence, testimony, discovery, argument, and/or other additional information that may be provided to me after the date of this report.

4. I am being compensated for my time spent working on this matter at my normal consulting rate of \$300 per hour, plus reimbursement for any additional reasonable expenses. My compensation is not in any way tied to the content of this report, the substance of my opinions, or the outcome of this litigation. I have no other interests in this proceeding or with any of the parties.

5. All of the materials that I considered are discussed explicitly in this declaration.

## II. QUALIFICATIONS

6. I am currently an Adjunct Professor in the School of Information at San José State University. I obtained a Masters of Library Science from the University of North Texas in 1972 and a Ph.D. in Library Science from the University of Pittsburgh in 1985. Over the last forty-five years, I have held various positions in the field of library and information resources. I was first employed as a librarian in 1966, and have been involved in the field of library sciences since, holding numerous positions.

7. I am a member of the American Library Association (ALA) and its Association for Library Collections & Technical Services (ALCTS) Division, and I served on the Committee on Cataloging: Resource and Description (which wrote the new cataloging rules) and as the chair of the Committee for Education and Training of Catalogers and the Competencies and Education for a Career in Cataloging Interest Group. I also served as the Chair of the ALCTS Division's Task Force on Competencies and Education for a Career in Cataloging. Additionally, I have served as the Chair for the ALA Office of Diversity's Committee on Diversity and as a member of the Editorial Board for the ALCTS premier cataloging journal, *Library Resources and Technical Services*.

8. I have also given over one hundred presentations in the field, including several on library cataloging systems and Machine-Readable Cataloging

(“MARC”) standards. My current research interests include library cataloging systems, metadata, and organization of electronic resources.

9. I have been deposed nine times: (1) *Symantec Corp. vs. Finjan, Inc.*, Petition for *Inter Partes Review* of U.S. Patent No. 7,613,926, May 26, 2016, on behalf of Symantec Corp.; (2) *Symantec Corp. vs. Finjan, Inc.*, 14-cv-299-HSG (N.D. Cal.), on behalf of Symantec Corp., September 14, 2017; (3) one deposition for ten matters: *Intellectual Ventures I LLC vs. AT&T Mobility LLC*; AT&T Mobility II LLC, New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Wayport, Inc., and Cricket Wireless LLC, C.A. No. 12-193 (LPS); *Intellectual Ventures II LLC vs. AT&T Mobility LLC*; AT&T Mobility II LLC, New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Wayport, Inc., and Cricket Wireless LLC, C.A. No. 13-1631 (LPS); *Intellectual Ventures I LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.*, C.A. No. 13-1632 (LPS); *Intellectual Ventures II LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.*, C.A. No. 13-1633 (LPS); *Intellectual Ventures I LLC, vs. Nextel Operations, Inc., Sprint Spectrum L.P., Boost Mobile, LLC and Virgin Mobile USA, L.P.*, C.A. No. 13-1634 (LPS); *Intellectual Ventures II LLC vs. Nextel Operations, Inc., Sprint Spectrum L.P., Boost Mobile, LLC and Virgin Mobile USA, L.P.*, C.A. No. 13-1635 (LPS); *Intellectual Ventures I LLC, vs. United States Cellular Corporation*, C.A. No. 13-1636 (LPS); *Intellectual Ventures I LLC vs. United States Cellular Corporation*,



C.A. No. 13-1637 (LPS); *Intellectual Ventures II LLC vs. AT&T Mobility LLC, AT&T Mobility II LLC, New Cingular Wireless Services, Inc.*, C.A. No. 15-799 (LPS); *Intellectual Ventures I LLC vs. T-Mobile USA, Inc. and T-Mobile US, Inc.*, C.A. No. 15-800 (LPS), on behalf of AT&T Mobility LLC; AT&T Mobility II LLC, Boost Mobile, LLC Cricket Wireless LLC, Nextel Operations, Inc., New Cingular Wireless Services, Inc., SBC Internet Services, Inc., Sprint Spectrum L.P., T-Mobile USA, Inc., T-Mobile US, Inc., United States Cellular Corporation Virgin Mobile USA, L.P., and Wayport, Inc., November 15, 2016; (4) *Hitachi Maxell, LTD., v. Top Victory Electronics (Taiwan) Co. Ltd., et al.*, 2:14-cv-1121 JRG-RSP (E.D. Texas), on behalf of Top Victory Electronics (Taiwan) Co. LTD, *et. al.*, January 20, 2016; (5) *Sprint Spectrum, L.P. vs. General Access Solutions, Ltd.*, Petition for *Inter Partes Review* of U.S. Patent No. 7,173,916, on behalf of Sprint Spectrum L.P., July 13, 2018; (6) *Nichia Corporation vs. Vizio, Inc.*, 8:16-cv-00545; on behalf of Vizio, Inc., October 12, 2018; (7) *Intellectual Ventures I LLC, vs. T-Mobile USA, Inc., T-Mobile US, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson*, 2:17-cv-00557 (JRG), on behalf of T-Mobile USA, Inc., T-Mobile US, Inc., Ericsson Inc., and Telefonaktiebolaget LM Ericsson, October 19, 2018; (8) *Pfizer, Inc. vs. Biogen, Inc.*, Petition for *Inter Partes Review* of U.S. Patent No. 8,821,873, on behalf of Pfizer, November 3, 2018; and, (9) *Finjan, Inc. vs. ESET, LLC and ESET SPOL. S.R.O.*, 3:17-cv-

00183-CAB-BGS, on behalf of ESET, January 15, 2019.

10. My full curriculum vitae is attached hereto as Attachment 1.

### **III. PRELIMINARIES**

11. *Scope of this declaration.* I am not an attorney and will not offer opinions on the law. I am, however, rendering my expert opinion on the authenticity of the documents referenced herein and on when and how each of these documents was disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, could have located the documents before what I understand to be the earliest claimed filing date of U.S. Patent 9,723,842 and U.S. Patent 9,717,250, which is May 26, 2006.

12. I am informed by counsel that a printed publication qualifies as publicly accessible as of the date it was disseminated or otherwise made available such that a person interested in and ordinarily skilled in the relevant subject matter could locate it through the exercise of ordinary diligence.

13. While I understand that the determination of public accessibility under the foregoing standard rests on a case-by-case analysis of the facts particular to an individual publication, I also understand that a printed publication is rendered “publicly accessible” if it is cataloged and indexed by a library such that a person interested in the relevant subject matter could locate it (*i.e.*, I understand that

cataloging and indexing by a library is sufficient, though there are other ways that a printed publication may qualify as publicly accessible). One manner of sufficient indexing is indexing according to subject matter category. I understand that the cataloging and indexing by a single library of a single instance of a particular printed publication is sufficient, even if the single library is in a foreign country. I understand that, even if access to a library is restricted, a printed publication that has been cataloged and indexed therein is publicly accessible so long as a presumption is raised that the portion of the public concerned with the relevant subject matter would know of the printed publication. I also understand that the cataloging and indexing of information that would guide a person interested in the relevant subject matter to the printed publication, such as the cataloging and indexing of an abstract for the printed publication, is sufficient to render the printed publication publicly accessible.

14. I understand that routine business practices, such as general library cataloging and indexing practices, can be used to establish an approximate date on which a printed publication became publicly accessible.

15. *Persons of ordinary skill in the art.* I am told by counsel that the subject matter of this proceeding relates to antimicrobial compositions and functional fluids comprising an antimicrobial composition.

16. I have been informed by counsel that a “person of ordinary skill in the art at the time of the invention” is a hypothetical person who is presumed to be familiar with the relevant field and its literature at the time of the inventions. This hypothetical person is also a person of ordinary creativity, capable of understanding the scientific principles applicable to the pertinent field.

17. I am told by counsel that persons of ordinary skill in this subject matter or art would have had at least an Associate’s degree in Chemistry, Biochemistry, or a related field, with 5-7 years of experience in coatings or biocide formulation. Higher degrees or higher degrees that are more specific to polymers and coatings need less work experience.

18. It is my opinion that such a person would have been engaged in research, learning, study, and practice in the field, and possibly formal instruction so that bibliographic resources relevant to his or her research would be familiar. In the mid-2000s such a person would have had access to a vast array of long-established print resources in Chemistry, Biochemistry, and Chemical Engineering, as well as to a rich set of online resources providing indexing information, abstracts, and full text services.

#### **IV. LIBRARY PROFESSIONAL PRACTICES**

19. In preparing this report, I used authoritative databases, such as the OCLC bibliographic database, the Library of Congress Online Catalog, and the

Library of Congress Subject Authorities, to confirm citation details of the various publications discussed. Unless I note otherwise below in reference to a specific serial publication, it is my expert opinion that this standard protocol was followed for the serial publication discussed below.

20. *U.S. Copyright Office.* Created by Congress in 1897, the Copyright Office is responsible for administering a complex and dynamic set of laws, which include registration, the recordation of title and licenses, a number of statutory licensing provisions, and other aspects of the *1976 Copyright Act* and the *1998 Digital Millennium Copyright Act*. The public catalog in the Copyright Office includes information filed since 1978 (<https://cocatalog.loc.gov/cgi-bin/Pwebrecon.cgi?DB=local&PAGE=First>). Individuals can search by title, personal or corporate name, key word, registration number, and document number. Works filed before 1978 can be located through the Copyright Public Records Reading Room (<https://www.copyright.gov/circs/circ23.pdf>). A researcher can find the date on which an item was published and deposited for copyright.

21. *Indexing.* A researcher may discover material relevant to his or her topic in a variety of ways. One common means of discovery is to search for relevant information in an index of periodical and other publications. Having found relevant material, the researcher will then normally obtain it online, look for it in libraries, or purchase it from the publisher, a bookstore, a document delivery

service, or other provider. Sometimes, the date of a document's public accessibility will involve both indexing and library date information. However, date information for indexing entries is often unavailable. This is especially true for online indices.

22. Indexing services use a wide variety of controlled vocabularies to provide subject access and other means of discovering the content of documents. The Library of Congress Subject Authorities includes standard forms of terms and cross references that are included in bibliographic records. The formats in which these access terms are presented vary from service to service.

23. Online indexing services commonly provide bibliographic information, abstracts, and full-text copies of the indexed publications, along with a list of the documents cited in the indexed publication. These services also often provide lists of publications that cite a given document. A citation of a document is evidence that the document was publicly available and in use by researchers no later than the publication date of the citing document.

## **V. LIBRARY CATALOGING PRACTICES**

24. I am fully familiar with the library cataloging standard known as the MARC standard, which is an industry-wide standard method of storing and

organizing library catalog information.<sup>1</sup> MARC was first developed in the 1960's by the Library of Congress. A MARC-compatible library is one that has a catalog consisting of individual MARC records for each of its items. Today, MARC is the primary communications protocol for the transfer and storage of bibliographic metadata in libraries.<sup>2</sup>

25. Since at least the early 1970s and continuing to the present day, MARC has been the primary communications protocol for the transfer and storage of bibliographic metadata in libraries.<sup>3</sup> As explained by the Library of Congress:

You could devise your own method of organizing the bibliographic information, but you would be isolating your library, limiting its options, and creating much more work for yourself. Using the MARC standard prevents duplication of work and allows libraries to better share bibliographic resources. Choosing to use MARC enables libraries to acquire cataloging data that is predictable and reliable. If a library were to develop a “home-grown” system that did not use MARC records, it would not be taking advantage of an industry-wide standard whose primary purpose is to foster communication of information.

<sup>1</sup> The full text of the standard is available from the Library of Congress at <http://www.loc.gov/marc/bibliographic/> (last visited July 6, 2019).

<sup>3</sup> A complete history of the development of MARC can be found in *MARC: Its History and Implications* by Henrietta D. Avram (Washington, DC: Library of Congress, 1975) and available online from the Hathi Trust (<https://babel.hathitrust.org/cgi/pt?id=mdp.39015034388556;view=1up;seq=1>; last visited July 6, 2019).

Using the MARC standard also enables libraries to make use of commercially available library automation systems to manage library operations. Many systems are available for libraries of all sizes and are designed to work with the MARC format. Systems are maintained and improved by the vendor so that libraries can benefit from the latest advances in computer technology. The MARC standard also allows libraries to replace one system with another with the assurance that their data will still be compatible.

*Why Is a MARC Record Necessary?* LIBRARY OF CONGRESS, <http://www.loc.gov/marc/umb/um01to06.html#part2> (last visited July 6, 2019).

26. Thus, almost every major library in the world is MARC-compatible. See, e.g., *MARC Frequently Asked Questions (FAQ)*, LIBRARY OF CONGRESS, <https://www.loc.gov/marc/faq.html> (last visited July 6, 2019) (“MARC is the acronym for MACHine-Readable Cataloging. It defines a data format that emerged from a Library of Congress-led initiative that began nearly fifty years ago. It provides the mechanism by which computers exchange, use, and interpret bibliographic information, and its data elements make up the foundation of most library catalogs used today.”). MARC is the ANSI/NISO Z39.2-1994 standard (reaffirmed in 2016) for Information Interchange Format. The full text of the standard is available from the Library of Congress at <http://www.loc.gov/marc/bibliographic/> (last visited July 6, 2019).

27. A MARC record comprises several fields, each of which contains



specific data about the work. Each field is identified by a standardized, unique, three-digit code corresponding to the type of data that follow. For example, a work's title is recorded in field 245; the primary author of the work is transcribed in field 100; an item's International Standard Book Number ("ISBN") consisting of ten or thirteen digits is transcribed in field 020; an item's International Standard Serial Number ("ISSN") is transcribed in field 022; the Library of Congress classification notation is recorded in field 050 or field 090; and, the publication date is recorded in field 260 under the subfield "c." If a work is a periodical, then its publication frequency is recorded in field 310, and the publication dates (e.g., the first and last publication) are recorded in field 362, which is also referred to as the enumeration/chronology field.<sup>4</sup>

28. The library that created the record is recorded in field 040 in subfield "a" with a unique library code. When viewing the MARC record online via Online Computer Library Center's ("OCLC") bibliographic database, hovering over this code with the mouse reveals the full name of the library. I used this method of "mousing over" the library codes in the OCLC database to identify the originating library for the MARC records discussed in this report. Where this "mouse over" option was not available, I consulted the Directory of OCLC Libraries in order to

<sup>4</sup> <http://www.loc.gov/marc/bibliographic/bd3xx.html>.

identify the institution that created the MARC record.<sup>5</sup>

29. MARC records also include several fields that include subject matter classification information. An overview of MARC record fields is available through the Library of Congress.<sup>6</sup> For example, 6XX fields are termed “Subject Access Fields.”<sup>7</sup> Among these, for example, is the 650 field; this is the “Subject Added Entry – Topical Term” field.<sup>8</sup> The 650 field is a “[s]ubject added entry in which the entry element is a topical term.” *Id.* These entries “are assigned to a bibliographic record to provide access according to generally accepted thesaurus-building rules (e.g., *Library of Congress Subject Headings* (LCSH), *Medical Subject Headings* (MeSH)).” *Id.* Further, MARC records include call numbers, which themselves include a classification number. For example, the 050 field is the “Library of Congress Call Number.”<sup>9</sup> A defined portion of the Library of Congress Call Number is the classification number, and “source of the classification number is *Library of Congress Classification* and the *LC Classification-Additions and Changes*.” *Id.* Thus, included in the 050 field is a subject matter classification. Each item in a library has a single classification number. A library selects a classification scheme (e.g., the Library of Congress

<sup>5</sup> <https://www.oclc.org/en/contacts/libraries.html>.

<sup>6</sup> <http://www.loc.gov/marc/bibliographic/>.

<sup>7</sup> <http://www.loc.gov/marc/bibliographic/bd6xx.html>.

<sup>8</sup> <http://www.loc.gov/marc/bibliographic/bd650.html>.

<sup>9</sup> <http://www.loc.gov/marc/bibliographic/bd050.html>.

Classification scheme just described or a similar scheme such as the Dewey Decimal Classification scheme) and uses it consistently. When the Library of Congress assigns the classification number, it appears as part of the 050 field. If a local library assigns the classification number, it appears in a 090 field. In either scenario, the MARC record includes a classification number that represents a subject matter classification.

30. The OCLC was created “to establish, maintain and operate a computerized library network and to promote the evolution of library use, of libraries themselves, and of librarianship, and to provide processes and products for the benefit of library users and libraries, including such objectives as increasing availability of library resources to individual library patrons and reducing the rate of rise of library per-unit costs, all for the fundamental public purpose of furthering ease of access to and use of the ever-expanding body of worldwide scientific, literary and educational knowledge and information.”<sup>10</sup> Among other services, OCLC and its members are responsible for maintaining the WorldCat database (<http://www.worldcat.org/>), used by independent and institutional libraries throughout the world.

31. OCLC also provides its members online access to MARC records

<sup>10</sup> Third Article, Amended Articles of Incorporation of OCLC Online Computer Library Center, Incorporated (available at <https://www.oclc.org/content/dam/oclc/membership/articles-of-incorporation.pdf>).

through its OCLC bibliographic database. When an OCLC member institution acquires a work, it creates a MARC record for this work in its computer catalog system in the ordinary course of its business. MARC records created at the Library of Congress are tape-loaded into the OCLC database through a subscription to MARC Distribution Services daily or weekly. Once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress, the MARC record is then made available to any other OCLC members online, and therefore made available to the public. Accordingly, once the MARC record is created by a cataloger at an OCLC member institution or is tape-loaded from the Library of Congress or another library anywhere in the world, any publication corresponding to the MARC record has been cataloged and indexed according to its subject matter such that a person interested in that subject matter could, with reasonable diligence, locate and access the publication through any library with access to the OCLC bibliographic database or through the Library of Congress.

32. When an OCLC member institution creates a new MARC record, OCLC automatically supplies the date of creation for that record. The date of creation for the MARC record appears in the fixed Field (008), characters 00 through 05. The MARC record creation date reflects the date on which, or shortly after which, the item was first acquired or cataloged. Initially, Field 005 of the

MARC record is automatically populated with the date the MARC record was created in year, month, day format (YYYYMMDD) (some of the newer library catalog systems also include hour, minute, second (HHMMSS)). Thereafter, the library's computer system may automatically update the date in Field 005 every time the library updates the MARC record (*e.g.*, to reflect that an item has been moved to a different shelving location within the library). Field 005 is visible when viewing a MARC record via an appropriate computerized interface, but when a MARC record is printed to hardcopy, no "005" label appears. The initial Field 005 date (*i.e.*, the date the MARC record was created) does appear, however, next to the label "Entered."<sup>11</sup> The date upon which the most recent update to Field 005 occurred at a local library appears next to the label "Replaced." Thus, when an item's MARC record has been printed to hardcopy—as is the case with the exhibits to this report—the date reflected next to the label "Entered" is necessarily on or after the date the library first cataloged and indexed the underlying item.

33. Once one library has cataloged and indexed a publication by creating a MARC record for that publication, other libraries that receive the publication do not need to create additional MARC records—the other libraries rely on the

<sup>11</sup> In this report, I sometimes refer to the "Entered" entry as field 008, characters 00-05. Field 005 is visible when viewing a MARC record via an appropriate computerized interface. But when a MARC record is printed directly to hardcopy from the OCLC database, the "005" label is not shown. The date in the 005 field instead appears next to the label "Replaced."

original MARC record. They may update or revise the MARC record to ensure accuracy, but they do not replace or duplicate it. This practice does more than save libraries from duplicating labor. It also enhances the accuracy of MARC records. Further, it allows librarians around the world to know that a particular MARC record is authoritative (in contrast, a hypothetical system wherein duplicative records were created would result in confusion as to which record is authoritative).

34. In addition, a local library may use a field in the 900-999 range to record local information regarding the cataloging, binding, storage, and status of an item. The 9XX fields are not part of the standard MARC 21 format.<sup>12</sup> For example, the Library of Congress uses the Field 955 to track the movements of an item through the cataloging process. The date and initials of the staff member performing a task is recorded, including (but not limited to) transfer to the Dewey Decimal team for the assignment of a classification number, the verification of the CIP (cataloging in publication) data, and transfer to the BCCD (Binding and Collection Care Division) for binding and preservation services. Data transcribed at local libraries that are important to establish dates of public availability are described for each of the documents described in this report.

35. Catalogers can create MARC records for all types of print, online, and digital resources. The date of creation of the MARC record by a cataloger at an

<sup>12</sup> <https://www.oclc.org/bibformats/en/9xx.html>.

OCLC member institution generally reflects when the underlying item is accessible to the public. Upwards of two-thirds to three-quarters of book sales to libraries come from a jobber or wholesaler for online and print resources. These resellers make it their business to provide books to their customers as fast as possible, often providing turnaround times of only a single day after publication. Libraries purchase a significant portion of the balance of their books directly from publishers themselves, which provide delivery on a similarly expedited schedule. In general, libraries make these purchases throughout the year as the books are published and shelve the books as soon thereafter as possible in order to make the books available to their patrons. Thus, books are generally available at libraries across the country within just a few days of publication.

36. MARC records cover serial publications, including both serially published monographs and journals. OCLC hosts MARC records for more than 320 million serial publications. Serial publications are those publications that have the same collective title but are intended to be continued indefinitely with enumeration such as a volume or issue number (*e.g.*, magazines, journals, etc.). In the OCLC bibliographic database, the first issue of the serial publication is typically cataloged (*i.e.*, a corresponding MARC record is created), but the date is left open-ended with the use of a punctuation mark such as a dash. OCLC serial publication MARC records represent the entire run of the serial title. With

knowledge of the first issue published, future issues can be predicted based on the information provided in the MARC record, for example in Field 362. In my extensive professional experience, is it highly unusual for a library to stop collecting and shelving a serial publication prior to the end of its publication run. If a subscription to a serial publication ends its run or is cancelled before the end of its run, the library will denote that it has stopped receiving new volumes by filling in the end date in the MARC record.

37. The handling of printed journal subscriptions is shown on the covers of individual issues. As was the best practice among libraries, issues arrived at a central facility and were immediately received, verified as part of a subscription, checked in, and stamped with the institution's name and date. Determining that the issue was part of the library subscription ensured that the entire set of publications for the year had been received so that they could be professionally bound and retained. This process also verified that all of the published issues arrived so that the library staff did not have to request or claim an issue that did not arrive as expected. In large public libraries with branches and multi-campus libraries within academic institutions, the journals were sorted and delivered to the subscribing unit. The issues were frequently stamped again to acknowledge receipt. The new issue was placed in the public area; the older issue was stored so that it remained available.



38. The foregoing process has been standard library practice longer than I have been working in the profession. I first learned the steps in the process in the late 1970s and later supervised it. Although the checking in process has become automated and now links electronically to holdings records for the MARC record for each serial title, the manual stamping and placing the issue in a public area has not changed for 50 years. Unless I note otherwise below in reference to a specific serial publication, it is my expert opinion that this standard protocol was followed for each of the serial publications discussed below.

**VI. PUBLICATION 1 -- Exhibit 1004 (IPR2019-01497), and 1104 (IPR2019-01498), and 1007 (IPR2019-01499) FROM HANDBOOK OF COATINGS ADDITIVES (“HANDBOOK”)**

39. Exhibit 1004 in IPR 2019-01497, Exhibit 1104 in IPR2019-01498, and 1007 in IPR2019-01499, are identical copies of excerpts of the book, *Handbook of Coatings Additives*, 2<sup>nd</sup> edition, edited by John J. Florio and Daniel J. Miller issued by M. Dekker with a 2004 copyright (hereinafter called “Handbook”). For brevity, I will refer to this document as Exhibit 1004/1104/1007. The excerpt is the title page, verso of the title page, copyright page, and the chapter titled “Biocides: Wet State and Dry Film.” The exhibit filed as Exhibit 1004/1104/1007 is a true and correct copy of the title page, verso of the title page, table of contents, and the chapter titled “Biocides: Wet State and Dry Film” within the Handbook I obtained a copy of the Handbook from the Linda Hall Library.

Specifically, the text of the book is complete; no pages are missing, and the text on each page appears to flow seamlessly from one page to the next; further, there are no visible alterations to the document. I also have examined Exhibit 1004/1104/1007, and the excerpts in Exhibit 1004/1104/1007 are identical to the Handbook I received from the Linda Hall Library. Thus, the Handbook, as depicted in Exhibit 1004/1104/1007, was found within the custody of a library – a place where, if authentic, a copy of this volume would likely be. Exhibit 1004/1104/1007 is a true and correct copy of excerpts of the Handbook in a condition that creates no suspicion about its authenticity.

40. Attached hereto as Attachment 2 is a true and correct copy of the MARC record for this book from the Linda Hall Library. The library ownership is indicated by the presence of the library's code (LHL) in the 049 field. The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules. I personally identified and retrieved the library catalog record which is Attachment 2.

41. Based on finding a copy of Handbook in the Linda Hall Library and a record in its online library catalog attached as Attachment 2, it is my opinion that the book, *Handbook of Coatings Additives*, 2<sup>nd</sup> edition, edited by Florio and Miller was cataloged on July 22, 2004, as shown in field 008 ("040722"). The most recent modification of the MARC record occurred on November 15, 2004, as

indicated in field 005 (“20041115”).

42. Attachment 2 further includes an entry in field 090 (“TP156.C57 ðb H36 2004”)—as described above, this includes a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system). Attachment 2 further includes an English language field 650 entry reading “Coatings ðx Additives ðv Handbooks, manuals, etc.” (see Attachment 3, Library of Congress subject heading sh2008004872). Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 2 was indexed according to its subject matter by virtue of at least two independently sufficient classifications: the field 090 entry and the field 650 entry. Further, as of July 22, 2004, the MARC record attached hereto as Attachment 2 was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that acquired the Florio book.

43. Attached hereto as Attachment 4 is a true and correct copy of the MARC record for the *Handbook of Coatings Additives*, 2<sup>nd</sup> edition, edited by Florio and Miller at the Library of Congress. I personally identified and retrieved the library catalog record which is Attachment 4. The 955 field indicates that Florio was received and sent to Dewey on April 10, 2006, as indicated by those fields with “2006-04-10” date codes. Those dates match the date that the Florio

book was cataloged, as shown in field 008 (“060303”). Final verification was performed on May 2, 2006. The data in the 955 fields for the Library of Congress MARC record indicates that Florio was cataloged on March 3, 2006 and that final processing occurred on May 2, 2006, and the book was publicly available on or shortly after that date at the Library of Congress. Any person can enter the Library of Congress and request a book be brought to a reading room.

44. Attached hereto as Attachment 5 is a true and correct copy of the MARC record for the *Handbook of Coatings Additives*, 2<sup>nd</sup> edition, edited by Florio and Miller obtained from the OCLC bibliographic database. As previously noted, the library that created the record is recorded in field 040 with a unique library code. For Exhibit 1004/1104/1106, that library code is “DLC,” which means that the MARC record for this book was cataloged at the Library of Congress. As can be seen in the “Entered” field in MARC record for this exhibit, a cataloger created OCLC record number 55993227 on March 3, 2006, as shown in the Entered field (“20060303”). The library continues to update this MARC record and enhanced the MARC record to meet current cataloging rules.

45. Attachment 5 further includes an entry in field 050 (“TP156.C57 ðb H36 2004”)—as described above, this includes a subject matter classification number consistent with the Library of Congress classification system (analogous to the Dewey Decimal classification system). Attachment 5 further includes an entry

in field 082 (“667/.9”), a subject matter consistent with the Dewey Decimal classification system. Attachment 5 further includes an English language field 650 entry reading “Coatings ‡x Additives ‡v Handbooks, manuals, etc.” (see Attachment 3, Library of Congress subject heading sh2008004872). Thus, as of its cataloging, the publication corresponding to the MARC record attached hereto as Attachment 5 was indexed according to its subject matter by virtue of at least three independently sufficient classifications: the field 050 entry, the field 082 entry, and the field 650 entry. Further, as of March 3, 2006, the MARC record attached hereto as Attachment 5 was accessible through any library with access to the OCLC bibliographic database or the online catalog at a library that acquired the Florio book.

46. Attachment 5 indicates that the *Handbook of Coatings Additives*, 2<sup>nd</sup> edition, edited by Florio and Miller as cataloged at the Library of Congress is currently available from 86 libraries, as indicated by the number of other holdings stated at the top of the MARC record. The Florio book has been available at academic and public libraries across the United States since its publication.

47. Not only was Handbook accessible and available to others in the field as early as July 22, 2004, researchers actually obtained and cited this book in other works, which is still further confirmation of its availability and accessibility. For example, Google Scholar indicates that this book has been cited at least 40 times.

Attachment 6 reports the number of citing references shown in Google Scholar for Exhibit 1004/1104/1007.

48. Therefore, the Handbook book (excepts of which are Exhibit 1004/1104/1007) was publicly accessible as early as July 22, 2004, and in any event more than one year before the earliest claimed priority date of U.S. Patent 9,723,842 and 9,717,250, which is May 26, 2006, because by that time it had been received, cataloged, and indexed at the Linda Hall Library.

## **VII. SUMMARY OF OPINIONS**

49. In view of the foregoing, it is my opinion that the publication described above was publicly available on or shortly after the corresponding date listed in the table below, and in any event more than a year before the earliest claimed priority date, May 26, 2006.

Exhibit	Publication	Publicly Available As Of
1001	<i>Handbook of Coatings Additives</i> , edited by John J. Florio and Daniel J. Miller. 2nd ed. New York: M. Dekker, 2004.	July 22, 2004

50. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-

examination within the United States during the time allotted for cross-examination.

51. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

DATED: August 15, 2019

By: Sylvia D. Hall-Ellis  
Dr. Sylvia D. Hall-Ellis

89958845.1

# **Attachment 1**



**CURRICULUM VITAE  
SYLVIA D. HALL-ELLIS**

**EDUCATION**

Ph.D., University of Pittsburgh, Pittsburgh, Pennsylvania, 1985  
M.P.S., University of Denver, Denver, Colorado, 2014  
Post Graduate Studies, University of Texas – San Antonio, Texas, 1975-1976  
M.L.S., University of North Texas, Denton, Texas, 1972  
B.A., Rockford University, Rockford, Illinois, 1971

**PROFESSIONAL EXPERIENCE**

- 1981- Consultant for higher education, non-profit organizations, and corporations.**
- 2002- Adjunct Professor, School of Information, San José State University, San José, California.** Serve as part-time faculty member teaching graduate students in technical services (cataloging, bibliographic control, classification), “core courses,” and special topics.
- 2014-2016 Director, Grants and Resource Development, Colorado Community College System.** Provided leadership and vision to foster the continued growth of rigorous scholarship, innovative projects, and creative work for statewide system, 13 campuses, and 50 teaching sites serving 155,000 students. Responsible for leadership and ensured efficient functioning of contract and grants in compliance with state & federal requirements and successful implementation and management. Served as a subject matter expert and liaison for college Grant Directors for all issues relating to grants and subcontracts.
- 2010-2014 Senior Grant Administrator, Morgridge College of Education, University of Denver (Colorado).** Provided leadership and vision to foster continued growth of rigorous scholarship, innovative research, and creative work in the Morgridge College of Education. Ensure that contract and grants processes function effectively and efficiently for 60 faculty and researchers with a focus on the successful progression and efficient management of grants totaling \$13M. Worked effectively and collegially with Department Chairs and Program Coordinators on operational grant-related management activities and with a broad range of internal and external constituencies. Supported the dissemination and promotion of faculty research and scholarship to outside constituents at conferences and through publications. Assisted Principal Investigators and grant project teams by coaching, mentoring, and financial management.
- 2011-2013 Interim Director & Assistant Dean, Westminster Law Library, Sturm College of Law, University of Denver.** Planned, organized, and directed all administrative activities for the library serving students, faculty, and alumni; oversaw the employment, retention, promotion, transfer and termination of library personnel; represented the library at professional conferences and public meetings; created and promoted a climate and culture of acceptance for new programs and services, a positive high-quality image of the law library, and that reflect the organization’s values, encourage excellent performance, and reward high productivity and innovation; provided leadership and set strategic direction of the organization; ensured that the library provided excellent customer service through solution-oriented staff response to patron needs and by responsiveness and continuous improvement of the organization; promoted, developed, and maintained positive working relationships with colleagues and customers including key stakeholders and groups, higher education institutions, the legal community, other regional libraries and districts statewide, and national library organizations.
- 2007-2014 Associate Professor, Library & Information Science, Morgridge College of Education, University of Denver (Colorado).** Served in leadership role and worked collaboratively in program, college, campus and community environments. Advised and supervised students, taught core and specialized courses at the graduate level in an integrative, student-centered learning environment. Served on LIS, College, and University committees, and maintained

working relationships with colleagues in other academic units and information professionals in the Rocky Mountain region and beyond. Served on and chair doctoral student dissertation committees. Oversaw and facilitated the College and LIS graduate student association.

- 2002-2007**      **Assistant Professor, Library & Information Science, College of Education, University of Denver (Colorado).** Served as tenure-track faculty member teaching graduate students in “core courses,” resource description and access, service learning, and independent studies. Advised graduate students, participate on LIS and College committees, and serve on doctoral student dissertation committees. Oversaw and facilitated the LIS graduate student association and alumni association.
- 2000-2002**      **Affiliate Faculty, Library & Information Science, College of Education, University of Denver (Colorado).** Served as part-time faculty member teaching graduate students in technical services (cataloging, bibliographic control, classification), “core courses,” and special topics. Oversaw and facilitated the LIS graduate student association and alumni association.
- 2000-2001**      **Special Assistant to the Secretary’s Regional Representative, U.S. Department of Education, Region VIII, Denver, Colorado.** Served as the principal advisor and representative of the U. S. Secretary of Education’s Regional Representative (SRR). Ensured the implementation of major goals of the SRR and the Secretary. Provided leadership on behalf of the SRR in contacts with high-level officials in Region VIII requiring sensitive policy interpretation in communication with senior Department officials to solve problems and resolve issues raised by State and local education officials. Served as the primary contact for School-to-Work/Career, Children’s Health Insurance Program, and Safe and Drug-Free Schools. Delivered technical assistance to local education agencies and institutions of higher education in technology, professional development, and school construction.
- 1999-2000**      **Catalog Librarian, Jefferson County Public Library, Lakewood, Colorado.** Performed original, copy cataloging and classification of library materials (English and Spanish) using standard library protocols; completed original descriptive cataloging and subject analysis; enhanced brief catalog and authority records in III.
- 1997-1999**      **Development Officer, McREL International, Aurora, Colorado.** Served as senior member of corporate management team in strategic planning, development of proposals and contracts, implementation, and evaluation of new services, products, and programs for educational agencies. Provided creative leadership to corporate committees to solicit ideas, identify goals and objectives, plan, develop, present, and evaluate professional development opportunities.
- 1995-1997**      **Education Specialist, Education Service Center, Region One, Edinburg, Texas.** Served as member of Administrative Cabinet team in strategic planning, development of proposals and contracts, implementation, and evaluation of telecommunications capabilities, services, products, and programs for 40 school districts serving 283,000 students in 7 counties. Provided creative leadership to regional and state committees to solicit ideas, identify strategic goals and objectives, plan, develop, present, and evaluate funding opportunities and professional development for 400 librarians.
- 1993-1996**      **Assistant Professor of Library Science, Sam Houston State University, Huntsville, Texas.** Served a faculty member teaching 400 graduate students in technical services (cataloging, bibliographic control, classification), automation, and networking. Participated in distance education program and coordinated annual conference. Conducted university and Texas Library Association-funded field research focused on library collection development and academic achievement.

- 1992-1993**      **Head Librarian, Rocky Mountain College of Art & Design, Denver, Colorado.** Responsible for the daily operation, selection and acquisition of materials, formulation of policies for library operations, media center, and photography/slides archives. Designed and implemented library automation and delivery of electronic resources to college community.
- 1981-1985**      **Development Officer, PRLC, Inc., Pittsburgh, Pennsylvania.** Served as senior member of corporate management team in strategic planning, development of proposals and contracts, implementation, and evaluation of new services, products, and programs for 100 institutional member organizations. Coordinated the development of proposals and contracts totaling \$4,000,000 annually. Provided creative leadership to corporate committees to solicit ideas, identify goals and objectives, plan, develop, present, and evaluate professional development opportunities.
- 1981**            **Director of Library Development, Pennsylvania Department of Education, Harrisburg, Pennsylvania.** Responsible for statewide development, technical assistance, professional development, resource sharing, children's services, institutional library services, networking, and state aid program for all libraries throughout the Commonwealth. Functioned as liaison to Governor's Advisory Council, LSCA Advisory Council, District Administrators, private colleges, universities, consortia managers, and network directors. Supervised \$14,000,000 formula-based state aid program and \$3,000,000 grant awards to individual libraries, consortia, and networks.
- 1978-1981**      **Assistant Director, Southern Tier Library System, Corning, New York.** Coordinated operation of system-wide programs (technical assistance, professional development, resource sharing, technical services, outreach) to 40 public libraries in 5 counties serving 500,000 residents. Solicited ideas, identified goals, sponsored, and evaluated professional development opportunities and technical assistance sessions.
- 1976-1978**      **Division Librarian for Technical Services, Corpus Christi Public Libraries, Corpus Christi, Texas.** Provided leadership in acquisitions, cataloging, serials control, and processing for main library and 4 branches serving 250,000 residents. Participated as senior member of library management team. Compiled and prepared technical evaluations, reports, and statistical analyses of Division operations to measure the achievement and cost of annual goals, objectives, and staff performance.
- 1975-1976**      **System Coordinator, San Antonio Major Resource Center, San Antonio, Texas.** Served as senior member of the management team for District X Office, charged to provide technical assistance, resource sharing, media services, and professional development to librarians and staff representing 30 public library jurisdictions in 21 counties serving 1,500,000 residents. Functioned as liaison to System Director, staff, and members of governing bodies with the System Board of Directors and the Texas State Library and Historical Commission. Prepared LSCA grant applications and monitored awards totaling \$1,100,000 annually.
- 1973-1975**      **Bilingual Branch Librarian, San Antonio Public Library, San Antonio, Texas.** Worked as librarian providing reference, information, and readers' advisory services in branch serving 50,000 Spanish-speaking residents in southwest San Antonio. Participated in collection development and resource acquisition activities, specializing in children's work, Spanish language resources, and multicultural studies.
- 1972-1973**      **Librarian, Holding Institute, Laredo, Texas.** Worked as high school librarian serving 500 boarding students in Spanish-speaking environment of private school. Provided reference, research assistance, and library instruction to students and 35 faculty members.
- 1966-1971**      **Rockford Public Library, Rockford, Illinois.** Worked in branches as part-time as a Library Assistant, Clerk, and Page in city library serving 150,000 residents.

## PUBLICATIONS

### Editor-reviewed Monographs (Completed and in Progress)

Hall-Ellis, Sylvia D., and Mary Beth Weber. *Contemporary Cataloging in an RDA Environment: A Handbook for Students and Practitioners*. Chicago, IL: American Library Association. Under contract & In development.

*RDA Testing: Lessons Learned and Challenges Revealed*. Sylvia D. Hall-Ellis and Robert O. Ellett, Jr., eds. Binghamton, N.Y.: Haworth, 2012. 128 p.

Hall-Ellis, Sylvia D., Stacey L. Bowers, Christopher D. Hudson, and M. Claire Williamson. *Librarian's Handbook for Seeking, Writing, and Managing Grants*. Santa Barbara, Calif.: Libraries Unlimited, 2011. 315 p.

Hall-Ellis, Sylvia D., with Ann Jerabek, and Merrie W. Valliant. *Contemporary Cataloging: A Handbook for Practitioners and Students*. Open access text. Athens, GA: University of Georgia System Regents, 2011. 767 p.

Grealy, Deborah S. and Sylvia D. Hall-Ellis. *From Research to Practice: The Scholarship of Teaching and Learning in LIS Education*. Westport, Conn.: Libraries Unlimited, 2009. 175 p.

Hall-Ellis, Sylvia D. with J. Ann Jerabek. *Grants for School Libraries*. Westport, Conn.: Libraries Unlimited, 2003. 197 p.

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Hall-Ellis, Sylvia D., Doris Meyer, Frank W. Hoffmann, with J. Ann Jerabek. *Grant Writing for Small Libraries and School Library Media Centers*. Englewood, Colo.: Libraries Unlimited, 2000. 173 p.

### Editor-reviewed Chapters (Completed and In Progress)

Hall-Ellis, Sylvia D. "Grant Writing and Sponsored Research Funding for Academic Librarians." In *The New Librarianship*. Vol. 4. Bradford Lee Eden, ed. New York: Scarecrow Press, 2015. (pp. 163-174)

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Hall-Ellis, Sylvia D. "Applying for Grants from Foundations, Corporations, or Government." In *The Volunteers' Guide to Fundraising: Raise Money for Your School Team, Library or Community Group*. 1<sup>st</sup> ed. Ilona M. Bray, ed. Berkeley, Calif.: Nolo, 2011. (pp. 1-38 on accompanying disc)

Hall-Ellis, Sylvia D., ed. "Standard III: The Faculty." In the *Library and Information Science Program Self-Study Document for Accreditation by the American Library Association*. Denver, Colo.: University of Denver, Morgridge College of Education, 2010. 22 p.

Hall-Ellis, Sylvia D. "Library and Information Science Programs and Education for Catalogers and Metadata Specialists: Challenges for the Twenty-first Century." In *Conversations with Catalogers in the Twenty-First Century*. Elaine R. Sanchez, ed. Santa Barbara, Calif.: ABC-CLIO, 2010. (pp. 226-254)

Hall-Ellis, Sylvia D., ed. "Standard III: The Faculty." In the *Library and Information Science Program Self-Study Document for Accreditation by the American Library Association*. Denver, Colo.: University of Denver, College of Education, 2003. 15 p.

Lesesne, Teri S. and Sylvia D. Hall-Ellis. "The Selection, Evaluation, and Integration of Culturally Authentic Texts: A Case for Making the Online Catalog Reflect Parallel Cultures." In *Literacy: Traditional, Cultural, Technological*. Pittsburgh, Pa.: International Association of School Librarianship, 1995. (pp. 110-113)

Lesesne, Teri S. and Sylvia D. Hall-Ellis. *The Selection, Evaluation, and Integration of Culturally Authentic Texts: A Case for Making the Online Catalog Reflect Parallel Cultures*. In *Conference Proceedings of the 23<sup>rd</sup> Annual International Association of School Librarianship*, Pittsburgh, Pennsylvania, July 17-22, 1994. ERIC Document ED374816. 17 p.

Hall-Ellis, Sylvia D. "Curriculum Folio for School Library Media Specialist Programs." In the *National Council for Accreditation of Teacher Education Self-Study for Sam Houston State University*. Huntsville, Tex.: Sam Houston State University, College of Education and Applied Science, 1994. 25 p.

Bruntjen, Scott and Sylvia D. Hall. "Attempting to Automate: Lessons Learned Over Five Years." In *Advances in Library Administration*. Volume 4. Weston, Conn.: JAI Press, 1985. (pp. 177-192)

#### **Peer-Reviewed Journal Articles (Completed and In Progress)**

Hall-Ellis-Sylvia D. "Job Design for Cataloging and Metadata Librarians." Submitted to *Journal of Library Administration*. In progress.

Hall-Ellis, Sylvia D. "The Relationship of Situational Leadership and the Dreyfus Model of Skill Acquisition for Supervisors in Cataloging and Metadata Services." To be submitted to *Library Resources and Technical Services*. In progress.

Hall-Ellis, Sylvia D. *The Relationship of Core Competencies on Learning Outcomes and Employers' Expectations for Catalog Librarians and Metadata Specialists*. To be submitted to the *Journal of Education for Library and Information Science*. In progress.

Hall-Ellis, Sylvia D. "Building Cataloger Competencies: The Dreyfus Model as a Prototype for the Education and Professional Development of Catalog Librarians and Metadata Specialists in Bibliographic Control." To be submitted to the *Cataloging & Classification Quarterly*. In progress.

Hall-Ellis, Sylvia D. "Descriptive Impressions of Entry-Level Cataloger and Metadata Specialists Positions, 2000-2016: Reflections and Trends." To be submitted to *Library Resources and Technical Services*. In progress.

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- Hall-Ellis, Sylvia D. "Succession Planning and Staff Development – A Winning Combination." *The Bottom Line*, 28 no. 3 (May 2015): 95-98.
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- Hall-Ellis, Sylvia D. "Metadata Competencies for Entry-Level Positions: What Employers Expect as Reflected in Position Descriptions, 2000-2013." *Journal of Library Metadata* 15, no. 2 (June 2015): 102-134.
- Hall-Ellis, Sylvia D. "Onboarding to Improve Library Retention and Productivity." *The Bottom Line* 27, no. 4 (October 2014).
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- Hall-Ellis, Sylvia D. and Deborah S. Grealy. "Service Learning in LIS Education: A Case for Holistic Assessment." *Catholic Library World* 82, no. 3 (March 2012): 178-187.
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- Hall-Ellis, Sylvia D. "Cataloger Competencies...What Do Employers Require?" *Cataloging & Classification Quarterly* 46, no. 3 (2008): 305-330. <http://ccq.haworthpress.com/doi:10.1080/01639370802034565>
- Hall-Ellis, Sylvia D. "Subject Access for Readers' Advisory Services: Their Impact on Contemporary Spanish Fiction in Selected Public Library Collections." *Public Library Quarterly* 27, no.1 (2007): 1-18. <http://plq.haworthpress.com/doi:10.1080/01616840802122377>
- Hall-Ellis, Sylvia D. "Language Proficiencies among Catalogers and Technical Services Librarians." *Technical Services Quarterly* 25, no. 2 (2007) 31-47. [http://tsq.haworthpress.com/doi:10.1300/J124v25n02\\_03](http://tsq.haworthpress.com/doi:10.1300/J124v25n02_03)

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- Hall-Ellis, Sylvia D. "Descriptive Cataloging Proficiencies among Beginning Students: A Comparison among Traditional and Virtual Class Students." *Journal of Library & Information Services in Distance Education* 2, no. 2 (2005): 13-44.
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- Hall-Ellis, Sylvia D. and Mary Ann Berry. "The Impact of Library Resource Centers on Academic Achievement in Selected Public Schools in South Texas: Preliminary Findings." *Texas Library Journal* 71, no. 2 (Summer 1995): 94-97.
- Hall-Ellis, Sylvia D. "Visual Arts as Foundation for Successful Library Automation: The Rocky Mountain College of Art & Design Experience." *Art Reference Serials Quarterly* 4 (1994): 43-54.
- Hall, Sylvia D. *High School Databases: An Examination of Bibliographic Data Elements*. Dissertation. Pittsburgh, Pa.: University of Pittsburgh, School of Library and Information Science, 1985.

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- Hall-Ellis, Sylvia D. *Colorado Community College System Grant Handbook*. Denver, CO: Colorado Community College System, 2015.
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*Faculty Voices: Testimonials from the Frontiers of a Development Education Redesign*. Elaine DeLott Baker, Marilyn Smith, and Sylvia D. Hall-Ellis, eds. Denver, CO: Colorado Community College System, 2014.
- Lewis, Melanie, Jamie M. Van Leeuwen, and Sylvia D. Hall-Ellis. *Project Homeless Connect 7 Event Evaluation*. Denver, Colo.: University of Colorado Denver, 2009.
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- Hall-Ellis, Sylvia D. *Lewis & Clark Fellows Concept Paper for the Bicentennial Commemoration*. Vancouver, Wash.: Lewis and Clark Bicentennial Council, 1998.
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- Hall-Ellis, Sylvia D. and Clarence L. Coffindaffer. *Partners in Progress: The 1992 Montana Library Federation Study Final Report*. Helena, Mont: Montana State Library and The Blue Bear Group, Inc., 1992.



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- Hall, Sylvia D. *Iowa Computer-Assisted Network (ICAN Users' Manual. IBM Compatible Edition: Version 5.0*. Des Moines, Ia.: State Library of Iowa, 1986.
- Hall, Sylvia D. *Iowa Computer-Assisted Network (ICAN Users' Manual. Apple MacIntosh Edition: Version 5.0*. Des Moines, Ia.: State Library of Iowa, 1986.
- Bruntjen, Scott and Sylvia D. Hall. *The District of Columbia Public Library Planning for Retrospective Conversion of Bibliographic Records and Automation Issues for the 1990's: Final Report*. Central City, Colo.: The Blue Bear Group, Inc., 1986.
- Bruntjen, Scott and Sylvia D. Hall. *The Iowa Locator: Final Report*. Central City, Colo.: The Blue Bear Group, Inc., 1986.
- Bruntjen, Scott and Sylvia D. Hall. *Discovering Resource Sharing Treasures: Accessing Pennsylvania's High School Library Collections*. Harrisburg, Pa.: State Library of Pennsylvania, Bureau of School Library Media Resources, 1985.
- Hall, Sylvia D. *Retrospective Conversion and the Completeness of Cataloging in Pennsylvania High School Libraries*. Pittsburgh, Pa.: PRLC, Inc., 1985.
- Bruntjen, Scott and Sylvia D. Hall. *The Iowa Locator*. Des Moines, Ia.: State Library of Iowa, 1985-  
<http://www.statelibraryofiowa.org/ld/silo/locator>
- Bruntjen, Scott and Sylvia D. Hall. *ICAN Analysis*. Des Moines, Ia.: State Library of Iowa, 1985.
- Bruntjen, Scott and Sylvia D. Hall. *Zebras: Bar Codes, Standards, and Library Automation*. Central City, Colo.: The Blue Bear Group, Inc., 1985.
- Hall, Sylvia D. and Scott Bruntjen. *Access Pennsylvania*. Harrisburg, Pa.: State Library of Pennsylvania, 1984-  
<http://www.accesspa.org>
- Hall, Sylvia D. *Reconfiguration of the ITAC Cataloging Data Base to Machine Readable (MARC) Format*. Classified Document. Arlington, Va.: U. S. Army Intelligence and Threat Analysis Center, 1984.
- Bruntjen, Scott and Sylvia D. Hall. *South Dakota Library Automation Plan: Final Report*. Pittsburgh, Pa.: PRLC, Inc., 1982. Reprinted by the South Dakota State Library, 1983.
- Bruntjen, Scott and Sylvia D. Hall. *Altoona Automation Plan: Final Report prepared for the Altoona Area Public Library and the Altoona District Library Center*. Pittsburgh, Pa.: PRLC, 1983.
- Bruntjen, Scott, Sylvia D. Hall and Paul J. Pugliese. *College Space Utilization Study*. Pittsburgh, Pa.: PRLC, Inc., 1983.

Hall, Sylvia D. *Pennsylvania Public Library Film Center Union Catalog Cataloging and Technical Services Procedures Manual*. Pittsburgh, Pa.: PRLC, Inc., 1982.

Hall, Sylvia D. *History of Library Development in Pennsylvania: A Review and Content Analysis of the Plans, 1955-1980*. Pittsburgh, Pa.: PRLC, Inc., 1982.

Hall, Sylvia D. *Newspapers on Microfilm: A Listing of Newspapers in Allegheny, Chemung, Schuylers, Steuben, and Yates Counties*. Ithaca, N.Y.: South Central Reference and Research Council, 1981.

Hall, Sylvia D. *OCLC/ILL Subsystem at Southern Tier Library System*. Albany, N.Y.: SUNY/OCLC Network, 1980.

Hall, Sylvia D. *Retrospective Conversion for Major Public Libraries in South Central New York State: A Technical Report*. 2 vols. Corning, N.Y.: Southern Tier Library System, 1979-1980.

Hall, Sylvia D. *The Librarian and the Mexican-American Patron in Texas*. Austin, Tex.: Texas State Library, 1978.

### **Other Publications**

Hall-Ellis, Sylvia D., ed. *Library and Information Science Program Self-Study Document for Accreditation by the American Library Association*. St. Paul, MN: St. Catherine University, 2017. 255 p.

Hall-Ellis, Sylvia D., and Robert O. Ellett, Jr., guest editors. *RDA Testing: Lessons Learned and Challenges Revealed: A Special Issue of Cataloging & Classification Quarterly* 49, no. 7-8 (November 2011).

Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Fundamentals of Cataloging I: An Online ALCTS Course*. Chicago, Ill.: American Library Association, 2009.

Hall-Ellis, Sylvia D., Angela J. Kinney and Martha Ann Bace, editors. *Best Practices in Cataloging Education Identified at the 2007 ALCTS Pre-conference: A Special Issue of the Journal for Library and Information Science Education* 49, no. 2 (Spring 2008).

Hall-Ellis, Sylvia D. *Cataloging Education: A New Emphasis for the Library and Information Science Curriculum*. Presentation delivered to the ALCTS Pre-conference, 132<sup>nd</sup> Annual Conference, American Library Association, Washington, D.C., June 22, 2007. <http://www.loc.gov/aba/professional/>

Hall-Ellis, Sylvia D. "Cataloger Competencies: Do the Employers Require What the Professors Teach?" Presentation delivered to the ALCTS CCS Heads of Cataloging Discussion Group, 131<sup>st</sup> Annual Conference, American Library Association, New Orleans, Louisiana, June 26, 2006. <http://dlist.sir.arizona.edu/>

Hall-Ellis, Sylvia D., guest editor, with Deborah S. Grealy, Clara L. Sitter, and Tassos Petrou. *Library Students' Voices in Colorado: An Issue of Colorado Libraries* 31:1 (Spring 2005).

Hall-Ellis, Sylvia D., ed. *Library and Information Science Program Self-Study Document for Accreditation by the American Library Association*. Denver, Colo.: University of Denver, College of Education, 2003. 125 p. with CD-ROM.

Hall-Ellis, Sylvia D. and Deborah S. Grealy, guest editors. *Library Education in Colorado: An Issue of Colorado Libraries* 29, no. 2 (Summer 2003).

Hall-Ellis, Sylvia D., ed. *Library and Information Science Program Self-Study Document for Accreditation by the American Library Association*. Denver, Colo.: University of Denver, College of Education, 2003.

Hall-Ellis, Sylvia D. "Adaptive Furniture for the ADA-Qualified: An Investigative Study." 2001. Unpublished manuscript.

Hall-Ellis, Sylvia D. "Cataloging Electronic Serials: A Study in User Access and Article Delivery." 2001. Unpublished manuscript.

Hall-Ellis, Sylvia D. "E-books: Acquisition and Circulation Issues in Public Libraries." 2001. Unpublished manuscript.

Hall-Ellis, Sylvia D. "Authority Control and Its Importance in School Library Media Online Catalogs." 1999. Unpublished manuscript.

Hall, Sylvia D. "Cooperation Improving Service in San Antonio System." *Texas Libraries* XXXVII (Spring 1976): 27-29.

Hall, Sylvia D. "Summer is Sea Monstrously Fun!" *Texas Library Journal* L (December 1974): 224-226.

Hall, Sylvia D. "A Brief Annotated Bibliography of Non-book Materials on the Mexican American." *Texas Library Journal* XLVIII (October 1972): 213-232.

### Book Reviews

*ALA Book of Library Grant Money*. Ann Kepler, ed. 8th ed. Chicago, IL: American Library Association, 2011. 978-0-8389-1058-0, \$175.00 [*Colorado Libraries*, June 2012]

*Developing a Compensation Plan for Your Library*. Paula M. Singer and Laura L. Francisco, comps. 2nd ed. Chicago, IL: American Library Association, 2009. 978-0-8389-0985-0, \$57.00 [*Colorado Libraries*, March 2012]

*Frugal Librarian*. Carol Smallwood, ed. Chicago, IL: American Library Association, 2011. 978-0-83891-075-7, \$42.00 [*Colorado Libraries*, February 2012]

Dowlin, Ken. *Getting the Money: How to Succeed in Fundraising for Public and Nonprofit Libraries*. Westport, Conn.: Libraries Unlimited, 2008. 978-1-59158-597-X, \$50.00 [*Colorado Libraries*, February 2009]

Lundahl, Mats. *Bebo de Cuba; Bebo Valdés y Su Mundo*, by Mats Lundahl. Traducción de Linda Oakeshott Dragó. Barcelona: RBA Libros, 2008. 978-849-86-7259-6, \$33.99 [*Críticas*, November 2008]

Bonelli, Florencia. *Marlene*, by Florencia Bonelli. Buenos Aires: Aguilar, Altea, Taurus, Alfaguara, 2008. 978-987-04-0995-3, \$24.95 [*Críticas*, October 2008]

Keret, Etgar. Traducción de Ana María Bejarano. *Pizzería Kamikaze y Otras Relatos*. México, D.F.: Editorial Sexto Piso, 2008. 968-5679-29-0, no price given [*Críticas*, September 2008]

Littauer, Marita, and Florence Littauer. *Enriquece tu Comunicación*. Miami, Fla.: Editorial Unilit, 2008. 978-0-7899-1521-4, \$11.99 [*Críticas*, August 2008]

Martínez, Guillermo. *La Muerte Lenta de Luciana B*. New York: Rayo Planeta, 2008. 978-0-06-156551-9, \$14.95 [*Críticas*, May 2008]

Matthews, Joseph R. *The Evaluation and Measurement of Library Services*. Westport, Conn.: Libraries Unlimited, 2007. 978-1-59158-532-9, \$50.00 [*Colorado Libraries*, April 2008]

Gómez-Jurado, Juan. *A Masacre de Virginia Tech: Anatomía de una Mente Torturada*. Barcelona: Ediciones El Andén, 2007. 978-84-935789-4-7, €16.50 [*Críticas*, February, 2008]

Matthews, Joseph R. *Library Assessment in Higher Education*. Westport, Conn.: Libraries Unlimited, 2007. 978-1-59158-531-2, \$45.00 [*Colorado Libraries*, February 2008]

- Chacón, Inma. *La Princesa India: Cuando el Viento Azul*. México: Alfaguara, 2006. 970-770398-9, \$19.95 [Críticas, June 2006]
- Vargas Llosa, Mario. *Israel/Palestina: Paz o Guerra Santa*. fotogs. by Morgana Vargas Llosa. Spain/U.S.: Aguilar: Santillana, 2006. 84-03-09691-7, paper, \$19.95 [Críticas, May 2006]
- Findlay, Diane. *Digging into Dewey*. Fort Atkinson, Wisc.: Upstart Books, 2005. 978-1-932146-18-9, \$16.95 [Colorado Libraries, May 2006]
- Pequeñas Resistencias 4: Antología del Nuevo Cuento Norteamericano y Caribeño*. Menéndez, Ronaldo, Ignacio Padilla & Enrique del Risco, eds. Madrid: Páginas de Espuma, 2005. 84-95642-59-X, paper, \$36.95 [Críticas, April 2006]
- Rueda, André. *Vengo a Salvar a España: Biografía de Un Franco Desconocido*. Madrid: Nowtilus (Investigación Abierta), 2005. photogs., bibliog. 84-9763-202-8, paper, \$23.95 [Críticas, March 2006]
- Becerra, Ángela. *El Penúltimo Sueño*. 1<sup>st</sup> ed. Barcelona: Planeta, 2005. 84-08-05795-2, \$25.95. [Críticas, January 2006]
- Aguilar Camín, Héctor. *La Conspiración de la Fortuna*. 1<sup>st</sup> ed. México: Planeta, 2005. 970-37-0368-2, \$19.95 [Críticas, October 2005]
- México en Sus Libros*. Enrique Florescano with Pablo Mijangos, editors & compilers. 1<sup>st</sup> ed. México, D.F.: Taurus Aguilar, 2004. 968-19-0783-3, \$16.95 [Críticas, September 2005]
- Historia Económica de México*. Coordinator, Enrique Semo. México: Universidad Nacional Autónoma de México, Editorial Oceano de México, 2004. 13 vols. 970-32-0805+3 (obra completa), \$9.25 each [Críticas, August 2005]
- Czarnowsky, Christyne A. and Michael H. Williams. *Managing Your Wired Workforce: A Practical Guide*. Denver, Colo.: Bradford Pub., 2003. 1-883726-79-4, \$24.95 [Colorado Libraries, 2004]
- Abraham Lincoln*. Colección Grandes Biografías. Madrid: Edimat Libros, 2003. 84-8403-858-0, €4.95 [Críticas, 2004]
- Alponte, Juan María. *Colón: el Hombre, el Navegante, la Leyenda*. México, D.F.: Aguilar, 2003. 968-19-1260-8, \$16.95 [Críticas, 2004]
- Olcese Salvatecci, Alfieri. *Cómo Estudiar con Éxito: Técnicas y Hábitos Para Aprender Mejor*. México, D.F.: Alfaomega Grupo Editor, 2002. 970-15-0764-9 [Críticas, 2003]
- Mujeres Como Islas: Antología de Narradoras Cubanas, Dominicanas, Puertorriqueñas*. Edición: Olga Marta Pérez, Thelma Jiménez, Andrés Blanco D., eds. Santo Domingo, República Dominicana: Ediciones Ferilibro, 2002. 959-209-419-5 [Críticas, 2003]
- Tibol, Raquel. *Los Murales de Diego Rivera: Universidad Autónoma Chapingo*. México, D.F.: Editorial RM, Universidad Autónoma Chapingo, 2002. 968-5208-08-5 [Críticas, 2003]
- Lindsay-Poland, John. *Emperors in the Jungle: the Hidden History of the U.S. in Panama*. Durham, N.C.: Duke University Press, 2003. 0-8223-3098-9, \$18.95 [Críticas, 2003]
- Kaplan, Allison G. and Ann Marlowe Riedling. *Catalog It! A Guide to Cataloging School Library Materials*. Worthington, Ohio: Linworth Pub., 2002. 1-58683-014-7, \$44.95 [Colorado Libraries, 2002]

- Bardach, Ann Louise. *Cuba Confidential: Love and Vengeance in Miami and Havana*. New York: Random, 2002. 0-375-50489-3, \$25.95 [*Library Journal*, 2002]
- Swan, James. *Fundraising for Libraries: 25 Proven Ways to Get More Money for Your Library*. New York: Neal Schuman, 2002. 1-55570-433-6, \$69.95 [*Colorado Libraries*, 2002]
- Puig de Lange, Victoria. *Sol Con Agua*. Nashville, Tenn.: Editorial Vistazo/Ediciones Reio Negro, 2002. 0-9724506-0-2, \$17.75 [*Críticas*, 2002]
- The Encyclopedia of Latin American Politics*. Edited by Diana Kapiszewski; assistant editor, Alexander Kazan. Westport, Conn.: Oryx Press, 2002. 1-57356-306-4, \$74.95 [*Library Journal*, 2002]
- Vargas Lizano, Isabel. *Y Si Quieres Saber de Mi Pasado*. Con la colaboración de J.C. Vales. Madrid: Santillana Ediciones Generales, S.L., 2002. 84-03-09278-4, \$18.95 [*Críticas*, 2002]
- Ruy Sánchez, Alberto. *Los Jardines Secretos de Mogador: Voces de Tierra*. México, D.F.: Alfaguara, S.A., 2001. 968-19-0879-1, \$16.95 [*Críticas*, 2002]
- Chávez, Ricardo and Celso Santajuliana. *El Final de las Nubes*. Barcelona: RBA Libros, S.A., 2001. 84-7901-760-0, \$11.95 [*Críticas*, 2002]
- The Power of Language / El Poder de la Palabra: Selected Papers from the Second REFORMA National Conference*. Edited by Lillian Castillo-Speed and the REFORMA National Conference Publications Committee. Englewood, Colo.: Libraries Unlimited, 2001. 1-563089459, \$35.00 [*Colorado Libraries*, 2001]
- Martínez, Rubén. *Crossing Over: A Mexican Family on the Migrant Trail*. Metropolitan: Holt, 2001. 0-8050-4908-8, \$26.00 [*Library Journal*, 2001]
- Guevara, Ernesto "Che." *The African Dream: the Diaries of the Revolutionary War in the Congo*. Translated from the Spanish by Patrick Camiller. With an introduction by Richard Gott and a foreword by Aleida Guevara March. New York: Grove Press, 2001. 0-8021-3834-9, \$13.00 [*Library Journal*, 2001]
- Cooper, Gail and Garry Cooper. *New Virtual Field Trips*. Englewood, Colo.: Libraries Unlimited, 2001. 1-56308-887-8, \$27.50 [*Colorado Libraries*, 2001]

## **NATIONAL SERVICE & PROFESSIONAL AFFILIATIONS**

### **American Library Association**

Association for Library Collections & Technical Services

Cataloging, Classification, and Metadata Section

ALCTS Editorial Board, Member, 2015-

Committee on Cataloging: Description and Access, Member, 2008-2012

Test Site for RDA, Manager, 2009-2011

Nominating Committee, Member, 2007-2008

Committee for Education and Training of Catalogers, Chair, 2006-2007, Member, 2003-2007

Competencies & Education for a Career in Cataloging Interest Group, Chair, 2010-2012; Member, 2010-

President's Program Committee, 2015-2016

Education Committee, Member, 2005-2007

Task Force on Competencies and Education for a Career in Cataloging, Chair, 2007-2009

2007 Annual Meeting Pre-conference, "What They Don't Teach in Library School: Competencies,

Education and Employer Expectations for a Career in Cataloging," Steering Committee Chair

Fundraising Committee, Member, 2004-2006

Office of Diversity

Committee on Diversity, Chair, 2010-2011

Diversity Research Advisory Committee, Member, 2009-2010

Spectrum Scholar Mentor, 2009

Diversity Grants Review Committee, Member, 2007, 2010, 2012

Office of Statistics and Research

Research and Statistics Committee, Member, 2005-2007; Intern, 2003-2005

Library Research Round Table

Board of Directors, Member At-Large, 2009-2012

Member, 2003-

Office of Accreditation

Accreditation Panel Member (training completed 2004)

Accreditation Review Panel Member (training completed 2004)

### **REFORMA**

National Board of Directors, 2005-2013

National Fundraising Chair, 2005-2013

National Recruiting and Mentoring Committee, 2008-2010

Colorado Chapter, Secretary, 2004-2005

Colorado Chapter Liaison to National Board of Directors, 2004-2013

### **Online Audiovisual Catalogers Association (OLAC)**

### **American Association of Law Libraries (AALL)**

### **Colorado Association of Law Librarians (CoALL)**

### **Association for Library and Information Science Education (ALISE)**

University of Denver ALISE Representative, 2003-2008; 2010-2011

Membership Advisory Committee, 2007-2010

Technical Services Education Special Interest Group, 2003-

Garfield Doctoral Dissertation Award Reviewer, 2012

Garfield Doctoral Dissertation Scholarship Reviewer, 2014

### **American Association of University Professors (AAUP), 2006-**

### **American Grant Writers Association, 2014-**

### **Grant Professionals Institute, 2016-**

### **National Grants Management Association, 2014-**

Grant Reviewer (National and Regional Team Leader), U.S. Department of Education, 1998-

Grant Reviewer, Broadband Technologies Opportunity Program, U.S. Department of Commerce, 2009

Grant Reviewer, Institute of Museum and Library Services, 1998-2000  
Grant Reviewer, Colorado Department of Education, 2014-  
Grant Reviewer, Colorado State Library, 1998-  
Grant Reviewer, American Association of Community Colleges *Working Connections* program, 1999  
Peer Reviewer, *Journal for Library and Information Science Education*, 2005-  
Peer Reviewer, *Journal of Library Metadata*, 2009  
Peer Reviewer, *International Journal of Library and Information Science*, 2011  
Regular Columnist, *The Bottom Line*, 2013-2016  
Book Reviewer, *Library Journal*, 2001  
Book Reviewer, *Críticas*, 2002-2009  
Book Reviewer, *Colorado Libraries*, 2000-2012

## **REGIONAL SERVICE & PROFESSIONAL AFFILIATIONS**

### **Mountain Plains Library Association**

Professional Development Grants Committee, Member, 2005-2006  
Professional Development Policy and Guidelines Sub-committee Chair, 2006

### **Colorado Association of Libraries**

"Student Voices" Column Editor, *Colorado Libraries*, 2005-2006  
Conference Planning Committee, Member, 2002  
Technical Services and Automation Division, Chair, 2002-2003; Member, 2000-  
Academic Libraries Division, Peer Review Conference Papers Committee, Member, 2007-2009  
Education Committee, Member, 1988-1993  
Diverse Populations Committee, Member, 2009-2013

## **SERVICE TO THE UNIVERSITY OF DENVER**

Center for Teaching and Learning Faculty Advisory Board, 2007-2008; 2010-2012  
Center for Community Engagement and Service Learning Advisory Board, 2007-2012  
Faculty Senate  
Executive Committee, 2008-2013  
Nominations, Rules & Credentials Committee, Chair, 2008-2013; Member 2007-2013  
Appointment, Promotion, and Tenure Revision Committee, 2010-2012  
Grievance Policy Committee Member, 2007-2010  
Law Library Director Search Committee Chair, 2012-2013  
PROF Grant Review, College Representative to the University Review Team, 2006, 2008  
Project Homeless Connect Evaluations, Principal Investigator, 2006-2009  
University Technology Council, 2007-2009  
University of Denver Hyde Interviews for Incoming Freshmen, 2003-2012

## **SERVICE TO THE MORGRIDGE COLLEGE OF EDUCATION**

Appointment, Tenure & Review Committee  
Member, voting, 2003-2005; 2007- 2009  
Chair, Clinical Faculty Promotion & Tenure Policy Subcommittee, 2008-2009  
Member, Community Engagement Subcommittee, 2007-2009  
Member, Tenure Review Panel, 2003  
Advancement and Alumni Relations Committee, Chair, 2003-2007; Member, 2002-2007  
College Building Committee Member, 2004-2010  
College of Education Student Association, Faculty Advisor, 2004-2007; 2009-2010  
Faculty Senator, 2007-2013  
Research and Scholarship Committee, Chair, 2008-2009; Member, 2002-2003, 2008-2009  
Research and Grant Mentoring Committee, Chair, 2009-2010  
Research Task Force Member, 2010-2012  
Search Committee Member, Assistant Professor for Curriculum & Instruction, 2010-2011  
Workload Task Force Member, 2010-2011

### **SERVICE TO THE LIBRARY & INFORMATION SCIENCE PROGRAM**

Library and Information Science Student and Alumni Association, Faculty Advisor, 2002-2008  
ALA Student Chapter, Faculty Advisor, 2005-2008  
Beta Phi Mu Phi Chapter, Faculty Advisor, 2004-2014  
Steering Committee Member, Accreditation by the American Library Association, 2001-2004  
Search Committee Member, Associate Professor for LIS, 2006  
Search Committee Chair, Assistant Professors for LIS, 2003, 2005, 2006, 2007  
Search Committee Ex-Officio Member, Director for LIS, 2004

### **SERVICE TO SAM HOUSTON STATE UNIVERSITY**

Rio Roundup: South Texas Literature Conference, Conference Coordinator, 1993  
External Relations, Fund Raising, Grants Committee, Chair, 1993-1995  
Advisory Council Committee, Chair, 1993-1995  
Students, Admissions, and Advisement Committee, Chair, 1994  
Institutional Effectiveness Committee, Member, 1993-1995

### **SERVICE TO THE COLLEGE OF EDUCATION AND APPLIED SCIENCE**

Faculty Affairs Committee, Member, 1993-1995  
Curriculum Committee, Member, 1993-1995  
Continuing Education Committee, Member, 1993-1995

### **SERVICE TO THE COMMUNITY**

Denver/Boulder Games 2022, Board of Directors, Secretary-Treasurer, 2015-2018  
United Way Campaign Committee, College of Education, 2006  
Arapahoe County, Election Judge for the County Clerk and Recorder, 2000-2005  
Arthritis Foundation, Rocky Mountain Chapter, Certified Educator & Trainer, 1999-2008  
Bonfils Blood Center, Silver Level Donor, 2000-2016  
Denver Museum of Natural History, Docent, 1992  
Tech Prep of the Lower Rio Grande Valley, Inc. (Harlingen, Texas) Board of Directors, 1995-1997  
Executive Committee, 1996-1997; Chair, Development Committee, 1995-1997; Chair, Fiscal Agency Committee, 1995-1996; Chair, Colleges and Universities Committee, 1996-1997  
Gilpin County (Colorado) Public Library Board of Trustees, 1986-1989; Vice President, 1987-1989  
City of Central (Colorado) Economic Development Committee, 1987-1989  
Columbine Family Health Centers, Inc. (Nederland and Black Hawk, Colorado) Board of Directors, 1988-1989

### **CERTIFICATION**

Permanent Public Librarian Certificate - Pennsylvania, New York, Texas  
Westlaw Expert Witness, 2008-  
Certified Grant Writer®, 2016-

### **AWARDS AND HONORS**

Advanced Practitioner for Service Learning and Community Engagement, University of Denver, 2011  
Platinum Star Alumnae, College of Information, Library Science & Technologies, University of North Texas, 2009  
Commendation for Integration of Technologies in Teaching & Learning Environment, University of Denver, 2006  
Outstanding Adjunct Faculty Member Award, College of Education, University of Denver, 2002  
Beta Phi Mu, Pi, University of Pittsburgh, 1985  
Alpha Lambda Sigma, University of North Texas, 1972

*Albert Nelson Marquis Lifetime Achievement Award, Who's Who in America; Who's Who in American Women; Who's Who of Women Executives; Dictionary of International Biography; Who's Who in the East; Who's Who in the South and Southwest; Who's Who in the World; Who's Who of Online Professionals; Who's Who in Library and Information Science; 2,000 Notable Women; Who's Who of Emerging Leaders; Who's Who in Professional and Executive Women; Who's Who in American Education; International Who's Who of Professional and Business Women; International Leaders in Achievement; International Educator of the Year; Who's Who in Finance and Industry; Who's Who in Finance and Business*



### Invited International and National Conference Presentations

Hall-Ellis, Sylvia D. *Invest in Me -- I'm Your Future: Succession Planning for Libraries*. Keynote presentation delivered at the ALCTS President's Symposium, Boston, Mass., January 8, 2016.

Seidel, Kent E. and Sylvia D. Hall-Ellis. *Making Grants Work for You: Strategies for Doctoral Students and Early Career Scholars*. Presentation delivered at the University Council for Educational Administration, Early Career Scholars Session, Indianapolis, Ind., November 9, 2013.

Hall-Ellis, Sylvia D. *So You Want to be a Manager; Leadership Skills and Competencies for Technical Services Managers and Administrators*. Presentation delivered at the 138<sup>th</sup> Annual Conference, American Library Association, Chicago, Ill., June 29, 2013.

Seidel, Kent E., Karen S. Riley, Lyndsay Agans, Susan Korach, and Sylvia D. Hall-Ellis. *Making Grants Work for You (Instead of Just Working for Grants)*. A panel discussion delivered at the University Council for Educational Administration, Early Career Scholars Session, Denver, Colo., November 17, 2012.

Hall-Ellis, Sylvia D. *After the Great TS Reorganization: The Westminster Law Library*. Presentation delivered at the 137<sup>th</sup> Annual Conference, American Library Association, Anaheim, Calif., June 23, 2012.

Hall-Ellis, Sylvia D. *Conversations with Catalogers in the 21<sup>st</sup> Century*. A panel discussion sponsored by the ALCTS Competencies for a Career in Cataloging Interest Group, delivered at the 137<sup>th</sup> Annual Conference, American Library Association, Anaheim, Calif., June 22, 2012.

Hall-Ellis, Sylvia D., moderator. *Mid-Career Leaders Program*. A panel discussion sponsored by the ALA Committee on Diversity delivered at the 136<sup>th</sup> Annual Conference, American Library Association, New Orleans, La., June 26, 2011.

Hall-Ellis, Sylvia D., moderator. *Diversity Town Hall*. A community conversation sponsored by the ALA Committee on Diversity delivered at the 136<sup>th</sup> Annual Conference, American Library Association, New Orleans, La., June 24, 2011.

LaBarre, Kathryn, Sylvia D. Hall-Ellis, Karen Anderson, Rick Hasenyager, Christopher Cronin, and Penny Baker. *Briefings from RDA Test Participants*. A panel discussion delivered at the Midwinter Conference, American Library Association, San Diego, Calif., January 7, 2011.

Miksa, Shawne, Marjorie Bloss, and Sylvia D. Hall-Ellis. *Educating the Next Generation of Catalogers: Teaching RDA*. A panel discussion delivered at the 97<sup>th</sup> Annual Conference, Association for Library and Information Science Education, San Diego, Calif., January 7, 2011.

Hall-Ellis, Sylvia D., Robert Maxwell, John Hostage, and George Prager. *RDA Panel: What Cataloging Managers Need to Know*. Presentation delivered at the 103<sup>rd</sup> Annual Conference, American Association of Law Librarians, Denver, Colo., July 12, 2010.

Hall-Ellis, Sylvia D. and Stacey L. Bowers. *Catalogers in the RDA Environment: Skill Sets, Expectations and Challenges*. Presentation delivered at the 103<sup>rd</sup> Annual Conference, American Association of Law Librarians, Denver, Colo., July 11, 2010.

Hall-Ellis, Sylvia D. *Comfortable in Your Cataloging and Metadata Specialist Skin? Or, So You Want to Hire a Cataloger*. Presentation delivered to the ALCTS Research Group at the 134<sup>th</sup> Annual Conference, American Library Association, Chicago, Ill., July 11, 2009.

Perez, Megan, Sylvia D. Hall-Ellis, and Denise Anthony. *From Novice to Expert: Collaboration for Succession Planning*. A "hot topic" presentation delivered at the 14<sup>th</sup> ACRL Conference, Seattle, Wash., March 13, 2009.

- Hall-Ellis, Sylvia D. *Cataloging in the RDA Environment: Skill Sets, Expectations and Challenges*. Presentation delivered to the ALCTS Research and Publications Committee at the Midwinter Conference, American Library Association, Denver, Colo., January 24, 2009.
- Hall-Ellis, Sylvia D. *LIS Cataloging Education for the 21st Century: Expectations and Challenges*. A panel discussion held at the 95<sup>th</sup> Annual Conference, Association for Library and Information Science Education, Denver, Colo., January 23, 2009.
- Chu, Clara, Sylvia D. Hall-Ellis, and Mark Winston. *The Doctoral Degree & Building a Career*. A panel discussion delivered at the ALA Office of Diversity Spectrum Doctoral Fellows E.J. Josey Leadership Institute, Midwinter Conference, American Library Association, Denver, Colo., January 20, 2009.
- Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Fundamentals of Cataloging Course: An Overview of the ALCTS Online Course*. Presentation delivered to the ALCTS Big Heads Group, 133<sup>rd</sup> Annual Conference, American Library Association, Anaheim, Calif., June 30, 2008.
- Hall-Ellis, Sylvia D. *Employers' Expectations for Technical Services Librarians: What We Don't Know*. Presentation delivered to the ALCTS Research and Publications Committee Program, 133<sup>rd</sup> Annual Conference, American Library Association, Anaheim, Calif., June 28, 2008.
- Hall-Ellis, Sylvia D., Virginia R. Maloney, and Mary Stansbury. *Institutional Responses to Engaged Scholarship: The Carnegie Foundation Engaged University Classification at Two Universities*. Presentation delivered to the 94<sup>th</sup> Annual Conference, Association for Library and Information Science Education, Philadelphia, Pa., January 11, 2008.
- Hall-Ellis, Sylvia D. *Puzzles, Problems, and Predicaments*. Presentation delivered to the ALCTS Research Discussion Group, 132<sup>nd</sup> Annual Conference, American Library Association, Washington, D.C., June 23, 2007.
- Hall-Ellis, Sylvia D. *Cataloging Education: A New Emphasis for the Library and Information Science Curriculum*. Presentation delivered to the ALCTS Pre-conference, 132<sup>nd</sup> Annual Conference, American Library Association, Washington, D.C., June 22, 2007. <http://www.loc.gov/catdir/cpsocareercat.html>
- Ellett, Jr., Robert O. and Sylvia D. Hall-Ellis. *Copy Cataloging Done Smarter*. Presentation delivered to the International Conference on Interdisciplinary Information Sciences and Technologies (InSciT2006), October 25-28, 2006.
- Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Cooperative Cataloging: Challenges and Opportunities for Defense Libraries*. Presentation delivered to the 1<sup>st</sup> Annual Conference of Defense Libraries, Spanish Ministry of Defense, Madrid, Spain, July 7, 2006.
- Hall-Ellis, Sylvia D. *Cataloger Competencies: Do the Employers Require What the Professors Teach?* Presentation delivered to the ALCTS CCS Heads of Cataloging Discussion Group, 131<sup>st</sup> Annual Conference, American Library Association, New Orleans, La., June 26, 2006.
- Grealy, Deborah S. and Sylvia D. Hall-Ellis. *From Research to Practice: The Scholarship of Teaching and Learning in LIS Education*. Presentation delivered to the at the 92<sup>nd</sup> Annual Conference, Association for Library and Information Science Education, San Antonio, Tex., January 18, 2006.
- Hall-Ellis, Sylvia D. *Employers' Expectations for Entry-Level Catalogers: What Position Announcement Data Indicate*. Research paper delivered to the Technical Services Special Interests Group, 91<sup>st</sup> Annual Conference, Association for Library and Information Science Education, Boston, Mass., January 12, 2005.  
<http://dlist.sir.arizona.edu/>

Hall-Ellis, Sylvia D. *Common Errors in MARC Records Prepared by LIS Students: What Does It Mean?* Research paper delivered to the ALCTS CCS Cataloging Norms Discussion Group, Mid-Winter Conference, 90<sup>th</sup> American Library Association, San Diego, Calif., January 10, 2004.

Hall-Ellis, Sylvia D. *Visual Arts as Foundation for Successful Library Automation: The Rocky Mountain College of Art & Design Experience*. Paper delivered at the 6<sup>th</sup> Annual Conference of Higher Education, Charleston, S. C., 1993.

Hall, Sylvia D. *Design Elements for Bibliographic Databases: An Overview*. Paper delivered at the 14<sup>th</sup> Online National Conference, New York, 1983.

### **Invited Regional Conference Presentations**

Hall-Ellis, Sylvia D., Hudson, Christopher D., Brittany Cronin, and Kathryn Michaels. "The Colorado Law Project: Meeting the Public's Need for Legal Information." Panel discussion delivered at the Mountain Plains Library Association Conference, Billings, Mont., April 9, 2011.

Grealy, Deborah S. and Sylvia D. Hall-Ellis. *Education for Information Professionals in New Mexico: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the New Mexico Library Education Summit, Las Vegas, N.M., September 26, 2005.

Hall-Ellis, Sylvia D. *Public Library-School Library Partnerships*. Presentation delivered at the 3<sup>rd</sup> Annual Colorado Association of Libraries Conference with the Mountain Plains Library Association, Denver, Colo., October 22, 2004.

Hall-Ellis, Sylvia D. *Learn All You Can – Educational Partnership Opportunities for the Lewis and Clark Bicentennial Commemoration*. Paper delivered at the 3<sup>rd</sup> Annual Lewis and Clark Bicentennial Council National Planning Conference, Bismarck, N.D., April 26, 1998.

### **Invited State Conference Presentations**

Grealy, Deborah S. and Sylvia D. Hall-Ellis. *Academic Library Leadership Changes: Using Succession Planning and Mentoring*. Presentation delivered at the Minnesota Library Education Conference, St. Cloud, Minn., October 10, 2013.

Hall-Ellis, Sylvia D., Merrie Valliant, and Melissa Powell. *RDA: What Is It and What Do You Need To Do With It At Your Library?* Presentation delivered at the Colorado Library Consortium Spring Conference, Ft. Morgan, Colo., April 26, 2013.

Hall-Ellis, Sylvia D. *Service Learning and the Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 4<sup>th</sup> LEADS Scholars Orientation, Denver, Colo., August 5, 2009.

Hall-Ellis, Sylvia D. *Service Learning: Enhancement to Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 3<sup>rd</sup> LEADS Scholars Orientation, Denver, Colo., June 2008.

Hall-Ellis, Sylvia D. *Law Librarianship: A Community Conversation*. Sponsored by the Colorado Association of Law Libraries. Paper delivered at the Colorado Supreme Court Library, Denver, Colo., May 14, 2008.

Hall-Ellis, Sylvia D. *Opportunities and Challenges in Law Librarianship: A Community Conversation*. Presentation delivered at the Sturm College of Law, Denver, Colo., November 7, 2007.

Hall-Ellis, Sylvia D. *Grant Writing Resources for Nursing Professionals*. Presentation delivered at the Presbyterian / St. Luke's Health One Medical Center 1<sup>st</sup> Annual Research Symposium, Denver, Colo., October 17, 2007.

- Hall-Ellis, Sylvia D. *Project Homeless Connect 4 Event Evaluation – Insights and Lessons Learned*. Presentation delivered at the Homelessness Research Symposium: What is DU Doing about Homelessness in Denver, Denver, Colo., September 14, 2007.
- Hall-Ellis, Sylvia D. *Service Learning and the Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 2<sup>nd</sup> LEADS Scholars Orientation, Denver, Colo., August 10, 2007.
- Hall-Ellis, Sylvia D. *Education for Information Professionals in a Digital Environment: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 15<sup>th</sup> Spring Mountains and Plains Parapros Conference, Denver, Colo., February 24, 2007.
- Hall-Ellis, Sylvia D. *Public Library Service to Spanish-Speaking and Latino Residents in Denver: A Case Study*. Presentation delivered at the 4<sup>th</sup> Annual Colorado Association of Libraries Conference, Denver, Colo., November 10, 2005.
- Hall-Ellis, Sylvia D. *Education for Information Professionals in a Digital Environment: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 14<sup>th</sup> Annual Mountains and Plains Parapros Conference, Aurora, Colo., July 29, 2005.
- Hall-Ellis, Sylvia D. *Educational Opportunities: Library & Information Science Graduate Education at the University of Denver*. Presentation delivered at the 13<sup>th</sup> Annual Mountains and Plains Parapros Conference, Centennial, Colo., August 6, 2004.
- Hall-Ellis, Sylvia D. *Library Education & Training: Focus on the West: An LIS Faculty Member's Personal Response*. Presentation delivered at the 1<sup>st</sup> Annual Colorado Association of Libraries Conference, Keystone, Colo., October 18, 2002.
- Hall-Ellis, Sylvia D. *Grant Writing for School Librarians*. Presentation delivered at the 2002 Annual Colorado Education Media Association Conference, Colorado Springs, Colo., February 15, 2002.
- Hall-Ellis, Sylvia D. *Grants – Opportunities for the Future*. Paper delivered at the Southeast Regional Accountability Annual Conference, Lamar, Colo., November 12, 1998.
- Hall-Ellis, Sylvia D. *The Texas Library Connection and Interlibrary Loan: An Experiment in Resource Sharing*. Paper delivered at the Texas Computer Educators' Association Annual Conference, Austin, Tex., February 6, 1997.
- Hall-Ellis, Sylvia D. *Finding Grant Sources on the Internet: A Guide for Librarians*. Paper delivered at the 2<sup>nd</sup> Annual Institute for School Library Personnel, Pharr-San Juan-Alamo North High School, Pharr, Tex., July 29, 1996.
- Hall-Ellis, Sylvia D. *Mathematical and Logical Thinking: A Critical Intelligence*. Paper delivered at the 3<sup>rd</sup> Annual Paraprofessional Conference at the University of Texas - Pan American, Edinburg, Tex., March 8, 1996.
- Hall-Ellis, Sylvia D. *Cataloging Trends and Issues: Update Session*. Paper delivered at the 1<sup>st</sup> Annual Institute for School Library Personnel, South Texas Community College, McAllen, Tex., July 19, 1995.
- Hall-Ellis, Sylvia D. *Grant Writing: Tips and Encouragement for School Librarians*. Paper delivered at the 1<sup>st</sup> Annual Institute for School Library Personnel, South Texas Community College, McAllen, Tex., July 18 and 19, 1995.
- Hall-Ellis, Sylvia D. *How to Become an Expert Grant Writer*. Paper delivered at the 3<sup>rd</sup> Annual High School Principals' Academy, South Padre Island, Port Isabel, Tex., June 19, 1995.

Hall-Ellis, Sylvia D. *Texas Library Study: Results from Regions I and II*. Paper delivered at the 3<sup>rd</sup> Annual Technology Conference, Texas A&M University, College Station, Tex., November 18, 1994.

Hall-Ellis, Sylvia D. *Academic Achievement and Middle School Students*. Paper delivered at the 8<sup>th</sup> Annual Young Adult Conference, Sam Houston State University, Huntsville, Tex., November 5, 1994.

Hall-Ellis, Sylvia D. *Multimedia Resources for Library Leaders*. Paper delivered at the Institute for Librarians in A Multicultural Environment, Sam Houston State University, Huntsville, Tex., June 10, 1994.

Hall-Ellis, Sylvia D. *Finding the Resource: Empowering the User, or, the Case for Curriculum Based Subject Access to Learning Resource Center Collections*. Paper delivered at the 81<sup>st</sup> Annual Texas Library Association Conference, Corpus Christi, Tex., April 12-16, 1994.

Hall-Ellis, Sylvia D. and William H. Pichette. *Sam Houston State University Makes Use of OCLC/AMIGOS Collection Analysis CD*. Paper delivered at the 81<sup>st</sup> Annual Texas Library Association Conference, Corpus Christi, Tex., April 12-16, 1994.

Hall, Sylvia D. *Funding and Library Development in Pennsylvania: A Symbiotic Relationship*. Paper delivered at the Annual Graduate Student Colloquia, University of Pittsburgh, School of Library and Information Science, 1982.

Hall, Sylvia D. *Leadership for Public Library Trustees*. Paper delivered for the Trustees Division, Pennsylvania Library Association Annual Conference, Lancaster, Penn., 1981.

### **Seminar and Professional Development Presentations**

Taylor, Meredith, and Sylvia D. Hall-Ellis. *Talent Management and Succession Planning*. ALCTS eForum, held March 22, 2017.

Hirsh, Sandra, Heather O'Brien, Michelle Holschuh Simmons, Michael Krasulski, and Sylvia D. Hall-Ellis. *Information Services Today: An Introduction. Part 3: Information Services: Roles in the Digital Age*. Rowan and Littlefield in partnership with Library Journal webinar, recorded February 5, 2015.

Hall-Ellis, Sylvia D. and Jennifer Sweda. *Copy Cataloging in an RDA Environment*. ALCTS eForum, held May 14 and 15, 2013.

Hall-Ellis, Sylvia D. *Law Librarianship: A Community Conversation*. Sponsored by the Colorado Association of Law Libraries, presented at the Colorado Supreme Court Library, Denver, Colo., May 14, 2008.

Hall-Ellis, Sylvia D. and Beatrice Z. Gerrish. *Reading and Libraries: Recent Research in Reading*. Presentation at the Ricks Center for Gifted Education, Denver, Colo., March 4, 2008.

Hall-Ellis, Sylvia D. *Cataloger Competencies: Do the Employers Require What the Professors Teach?* Presentation for the School of Library and Information Science, San José State University, February 12, 2008.

Hall-Ellis, Sylvia D. and Robert O. Ellett, Jr. *Cooperative Cataloging: Rules, Tools, and Conventions for Building a Multi-institutional Catalog*. Sponsored for the Spanish Ministry of Defense, Madrid, Spain, July 10, 2006.

Hall-Ellis, Sylvia D. *Cash for Kids: Grant Writing Opportunities for Youth Services Librarians*. Sponsored by the Colorado Young Adult Librarians; presented at Bemis Memorial Library, Littleton, Colo., November 13, 2002.

Hall-Ellis, Sylvia D. *MARC Records and Authority Control: Planning for Bibliographic Database Migration*. Sponsored and held at the Douglas County Public Library, Castle Rock, Colo., May 28, 2002.

Hall-Ellis, Sylvia D. *Grant Writing: A Refresher for Librarians*. Sponsored by Library and Information Science Program, College of Education, University of Denver; presented at University Center at Chaparral, August 12, 2000.

Hall-Ellis, Sylvia D. *Shaking the Money Tree – Basic Grant Writing for Colorado Educators*. Sponsored by the Office of Educational Telecommunications of the Colorado Department of Education.  
Pikes Peak Community College, Colorado Springs, Colo., November 16, 1998.  
Pueblo School District 60, Pueblo, Colo., November 12, 1998.  
University of Northern Colorado, Greeley, Colo., November 10, 1998.  
United Technology Educational Partnership, Grand Junction, Colo., November 9, 1998.

Hall-Ellis, Sylvia D. *Cataloging Multimedia, Kits, Globes and Map Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 24, 1997 and December 12, 1996.

Hall-Ellis, Sylvia D. *New Standards for School Library Media Centers*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 15, 1997.

Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21<sup>st</sup> Century: Visions for the Future*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., April 4, 1997.

Hall-Ellis, Sylvia D. *Cataloging Sound Recordings and Audio Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., March 20, 1997 and November 21, 1996.

Hall-Ellis, Sylvia D. *Evaluating and Selecting CD-ROMs for School Library Media Collections*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., March 18, 1997.

Hall-Ellis, Sylvia D. *Cataloging Audiovisual Materials in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., February 27, 1997, November 7, 1996 and October 24, 1996.

Hall-Ellis, Sylvia D. *Introduction to Dialog: Basic Searching Strategies*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., February 14, 1997.

Hall-Ellis, Sylvia D. *Cataloging Books in USMARC*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., January 30, 1997, October 10, 1996, September 26, 1996 and August 8, 1996.

Hall-Ellis, Sylvia D. *Advanced Internet Searching Techniques for Librarians*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., January 21, 1997.

Hall-Ellis, Sylvia D. *Texas Library Connection Full-Text Searching*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., December 13, 1996 and October 25, 1996.

Hall-Ellis, Sylvia D. *Developing Evaluation Strategies for Grants and Proposals*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., December 10, 1996.

Hall-Ellis, Sylvia D. *Developing Needs Assessment for Grants and Proposals*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., November 12, 1996.

Hall-Ellis, Sylvia D. *Texas Library Connection Union Catalog Searching*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., November 8, 1996 and September 6, 1996.

Hall-Ellis, Sylvia D. *Grant Resources on the Internet*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., October 23, 1996.

- Hall-Ellis, Sylvia D. *Preparing a Response to the Telecommunications Infrastructure Fund Board: Needs Assessment, Professional Development Framework, and Evaluation Strategies*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., October 16, 1996.
- Hall-Ellis, Sylvia D. *Texas Library Connection: Building the Districtwide Bibliographic Database*. Sponsored and hosted by Mercedes Independent School District, Mercedes, Tex., September 13, 1996 and August 8, 1996. Sponsored and hosted by Los Fresnos Consolidated Independent School District, Los Fresnos, Tex., August 12, 1996.
- Hall-Ellis, Sylvia D. *School-to-Work and Special Education: An Inclusive Partnership for Success*. Sponsored and hosted by the Office of Special Education, Region One Education Service Center, Edinburg, Tex., September 11, 1996.
- Hall-Ellis, Sylvia D. *Telecommunications Infrastructure Fund Board: An Overview of Funding for Secondary Schools*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., August 31, 1996.
- Hall-Ellis, Sylvia D. *Cataloging Books, Multimedia, and Realia in USMARC*. Sponsored and hosted by Edinburg Consolidated Independent School District, Edinburg, Tex., August 6, 1996.
- Hall-Ellis, Sylvia D. *Internet Resources for Grant Writers*. Sponsored and hosted by Region One Education Service Center, Edinburg, Tex., April 20, 1996.
- Hall-Ellis, Sylvia D. *Enhanced Grant Writing Skills for Mathematics Educators: Writing Skills for Campus Teams*. Sponsored and hosted by the Office of General Education, Region One Education Service Center, Edinburg, Tex., March 22, 1996.
- Hall-Ellis, Sylvia D. *Internet Resources for Grant Writers*. Sponsored and hosted by the College of Education and Applied Science, Sam Houston State University, Huntsville, Tex., March 9, 1996.
- Hall-Ellis, Sylvia D. *Grant Writing for Mathematics Educators: A Development Process for Campus Teams*. Sponsored and hosted by the Office of General Education, Region One Education Service Center, Edinburg, Tex., March 4, 1996.
- Hall-Ellis, Sylvia D. *Shaking the Money Tree: Preparing Successful Technology Grant Applications*. Sponsored and hosted by the Office of Technology and Media Services, Region One Education Service Center, Edinburg, Tex., February 29, 1996 and April 29, 1996.
- Hall-Ellis, Sylvia D. *District-wide Technology Planning: Technical Assistance for the Texas Education Agency Initiative*. Sponsored and hosted by the Office of Technology and Media, Region One Education Service Center, Edinburg, Tex., February 2, 1996.
- Hall-Ellis, Sylvia D. *Enhanced Grant Writing Skills*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., January 27, 1996.
- Hall-Ellis, Sylvia D. *United States Copyright Act of 1976, Video Transmissions, Computer Software and the Internet*. Sponsored and hosted by the Office of Technology and Media, Region One Education Service Center, Edinburg, Tex., January 24, 1996.
- Hall-Ellis, Sylvia D. *The Grant Writing Development Process*. Sponsored and hosted by Pharr-San Juan-Alamo Independent School District, Pharr, Tex., January 20, 1996.
- Hall-Ellis, Sylvia D. *MARC Cataloging of Materials for Library Media Centers*. Sponsored and hosted by the Office of Media Services, Region One Education Service Center for the Donna Independent School District, Donna, Tex., August 17, 1995.

Hall-Ellis, Sylvia D. *Classification*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., May 10, 1995.

Hall-Ellis, Sylvia D. *Library Technical Services*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., April 26, 1995.

Hall-Ellis, Sylvia D. *Grant Writing: An Introduction for Public School Administrators*. Sponsored and hosted by the Office of Administrative Services, Region One Education Service Center, Edinburg, Tex., April 19, 1995.

Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21<sup>st</sup> Century: Visions for the Future*. Sponsored and hosted by the United Independent School District, Laredo, Tex., March 31, 1995.

Hall-Ellis, Sylvia D. *Using USMARC*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., March 29, 1995.

Hall-Ellis, Sylvia D. *Library Media Center Policies and Guidelines: How to Prepare for School Board Adoption*. Sponsored and hosted by the Office of Technology and Media Services, La Joya Independent School District, La Joya, Tex., March 10, 1995.

Hall-Ellis, Sylvia D. *Developing District-wide Policies and Guidelines for Library Media Centers*. Sponsored and hosted by the Office of Technology and Media Services, La Joya Independent School District, La Joya, Tex., January 10, 1995.

Hall-Ellis, Sylvia D. *MARC Cataloging of Audiovisual Materials for Library Media Centers*. Sponsored and hosted by the Office of Library Media and Technology Services, Cypress-Fairbanks Independent School District, Houston, Tex., December 1, 1994.

Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21<sup>st</sup> Century: Visions for the Future*. Sponsored and hosted by United Independent School District, Laredo, Tex., October 14, 1994.

Hall-Ellis, Sylvia D. *The School Library Media Specialist in the 21<sup>st</sup> Century: Visions for the Future*. Sponsored and hosted by the Laredo Independent School District, Laredo, Tex., October 7, 1994.

Hall-Ellis, Sylvia D. *MARC Cataloging for Library Media Centers*. Sponsored by the Office of Library Media and Technology Services, Cypress-Fairbanks Independent School District, Houston, Tex., October 5, 1994.

Hall-Ellis, Sylvia D. *Jump to the Head of the Class: Undergraduate Library Resources Available at Sam Houston State University*. Sponsored by the Office of the Associate Vice President for Student Services, Sam Houston State University, Huntsville, Tex., October 4, 1994.

Hall-Ellis, Sylvia D. *CD-ROMs - 1994's Newest and the Best for Secondary Level Media Centers*. Sponsored and hosted by Clear Lake Independent School District, Houston, Tex., June 3, 1994.

Hall-Ellis, Sylvia D. *Introduction to Classification*. Sponsored by AJ Seminars, Rockville, Maryland; presented at Holiday Inn, Market Center, Dallas, Tex., May 18, 1994.

Hall-Ellis, Sylvia D. *Basic Descriptive Cataloging*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., May 4, 1994.

Hall-Ellis, Sylvia D. *Shaking the Money Tree - Part II: Writing Successful Grant Applications*. Sponsored by Donna Independent School District, Donna, Texas, and Region One Education Service Center Edinburg, Texas; presented at South Texas Community College Library, McAllen, Tex., April 29, 1994.



Hall-Ellis, Sylvia D. *Using MARC*. Sponsored by AJ Seminars, Rockville, Maryland; presented at Holiday Inn, Market Center, Dallas, Tex., April 6, 1994.

Hall-Ellis, Sylvia D. *Automated Authority Control*. Sponsored by AJ Seminars, Rockville, Maryland; presented at University Hilton Hotel, Houston, Tex., March 23, 1994.

Hall-Ellis, Sylvia D. *Automating the District School Library Media Centers: Choices and Opportunities*. Sponsored and hosted by the Office of Technology and Library Media Services, Fort Bend Independent School District, Sugar Land, Tex., March 4, 1994.

Hall-Ellis, Sylvia D. *Shaking the Money Tree - Part I: Preparing Successful Grant Applications*. Sponsored and hosted by the Office of Library Media Services, Donna Independent School District, Donna, Tex., February 4, 1994.

## **GRADUATE COURSES TAUGHT**

### **San José State University, School of Library and Information Science**

INFO 249 – Advanced Cataloging and Classification (Fall 2015, 2016; Summer 2016)  
INFO 287 – Special Topics in Cataloging and Classification (Spring 2017, 2018, 2019)  
LIBR 248 – Beginning Cataloging and Classification (Summer 2002, 2003, 2004, 2005, 2006)  
LIBR 249 – Advanced Cataloging and Classification (Summer 2003; Fall 2014; Summer 2015)

### **University of Denver, Morgridge College of Education**

HED 5991 – Grant Writing in Higher Education (Spring 2011)  
LIS 4010 – Organization of Information (Fall 2002, 2003, 2004, 2005, 2006, 2009; Winter 2005; Spring 2004, 2005, 2006)  
LIS 4020 – Professional Principles and Ethics (Summer 2000)  
LIS 4040 – Management of Libraries and Information Centers (Fall 2010; Spring 2003, 2009 (DS); Winter 2005)  
LIS 4070 – Cataloging and Classification (Winter 2008, 2009, 2010, 2011, 2012; Fall 2009 (DS))  
LIS 4321 – Collection Management (Spring 2005)  
LIS 4326 – LIS Research (Winter 2009 (DS); Spring 2009 (DS))  
LIS 4350 – Adult Materials and Services (Summer 2006, 2009)  
LIS 4379 – Social Sciences Resources (Spring 2009)  
LIS 4400 – Cataloging and Classification (Spring 2000, 2001; Winter 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009; Summer 2005, 2006 – course renumbered LIS 4070, September 2007)  
LIS 4401 – Descriptive Cataloging (Winter 2001; Spring 2002, 2003, 2006, 2007, 2008, 2009; Summer 2005)  
LIS 4402 – Subject Cataloging (Spring 2001, 2009; Summer 2005, 2006, 2007, 2008)  
LIS 4403 – Classification Schemes (Fall 2007, 2008, 2009 (DS))  
LIS 4405 – Authority Control (Winter 2009)  
LIS 4510 – Materials and Services for Children (Winter 2004; Summer 2005)  
LIS 4620 – Grant Writing and Fundraising (Summer 2000, 2002, 2004, 2010; Winter 2006; Fall 2006, 2007, 2008, 2009)  
LIS 4700 – Seminar in Technical Services (Fall 2001)  
LIS 4700 – Seminar in Public Libraries (Summer 2002)  
LIS 4804 – Management of Electronic Records (Spring 2004; Fall 2005)  
LIS 4902 – Capstone Projects (Winter 2003, Spring 2008, 2009, 2011)  
LIS 4910 – Independent Study (every quarter Winter 2000 through Spring 2011)  
LIS 4920 – Service Learning (every quarter Summer 2004 through Spring 2011)  
RMS 4954 – Grant Writing (Summer 2013, 2014)  
RMS 4959 – Content Analysis Methodology (Spring 2015)  
QRM 4978 – Grant Writing (Summer 2011, 2012)

### **Rutgers University, School of Communication and Information**

SC&I 522 – Cataloging and Classification (Summer 2013)

### **University of Arizona, College of Behavioral and Social Sciences**

LIS 602 – Cataloging and Classification (Summer 1995)  
LIS 612 – Advanced Online Search and Retrieval (Summer 1995)

### **Sam Houston State University, College of Education & Applied Science**

LIS 532 - Cataloging and Classification (Fall 1993, 1994, 1995)  
LIS 563 - Advanced Cataloging and Classification (Summer 1994)  
LIS 567 - Research Methods (Spring 1994, Spring 1995)  
LIS 591 - Educational Technology (Spring 1994, 1995)  
LIS 596 - Networking and Computer Technologies in Education (Fall 1993, Summer 1994, Fall 1995)

### **Dissertations at the University of Denver**

- Bowers, Stacey L. *Library Anxiety of Law School Students: A Study Utilizing the Multidimensional Library Anxiety Scale*. Chair, May 5, 2010.
- Fattor, Melissa M. *Student Engagement Differences by Ethnicity and Scale for Ninth Grade Students*. Chair, November 1, 2010.
- Fulton, Roseanne. *A Case Study of Culturally Responsive Teaching in Middle School Mathematics*. Kent Seidel, Chair, June 18, 2009, Outside Chair.
- Grealy, Deborah S. *Tribes and Territories in Library and Information Studies Education*. Bruce Uhrmacher, Chair, June 10, 2008, Committee Member.
- McCord, J. Michael. *Developing a Standard of Care for Educational Malpractice*. Chair, April 15, 2011.
- Priebe, Sarah J. *Distinguishing Effects of Domain and General Knowledge on Passage Fluency and Comprehension*. Jan Keenan, Chair. July 21, 2011, Outside Chair.
- Snyder-Mondragon, Sandra M. *Institutional Factors that Impact the Retention of Graduate Students of Color in Schools of Library and Information Science: A Metaregression of Accredited Library School Statistics on Student Retention and Graduation Rates*. Kathy Green, Chair, July 24, 2009, Committee Member.
- Taylor, Karen Pickles. *Effective Teaching*. Elinor Katz, Chair, July 15, 2009, Outside Chair.
- Thompson, Jennifer. *Distinguishing a Western Women's College: A History of the Curriculum and Student Experience at Colorado Women's College*. Edith W. King, Chair, July 16, 2010, Committee Member.
- Walker, Emelda. *Influence of Organizational Factors on Job Satisfaction of Disability Service Providers at Postsecondary Institutions*. Chair, April 29, 2010.

### **Dissertation Proposals at the University of Denver**

- Bowers, Stacey L. *Library Anxiety of Law School Students: A Study Utilizing the Multidimensional Library Anxiety Scale*. Chair, November 5, 2009.
- McCord, J. Michael. *Developing a Standard of Care for Educational Malpractice*. Edith W. King, Chair. April 23, 2010.
- Thompson, Jennifer. *History of Colorado Women's College*. Edith W. King, Chair, October 30, 2008. Committee Member.
- Walker, Emelda. *Influence of Organizational Factors on Job Satisfaction of Disability Service Providers at Postsecondary Institutions*. Chair, July 21, 2009.

### **Dissertations at Other Institutions**

- Rodríguez-Mori, Howard. *The Information Behavior of Puerto Rican Immigrants to Central Florida, 2003-2009: Grounded Analysis of Six Case Studies Use of Social Networks during the Migration Process*. Kathleen Burnett, Chair, April 10, 2009, Florida State University, Committee Member.
- Schwartz, Brian *More than a Look-up Skill: Medical Information Literacy Education in Osteopathic Medical Schools*. D. Mirah Dow, Chair, July 18, 2017. Emporia State University, Committee Member.

Snow, Karen. *A Study of the Perception of Cataloging Quality among Catalogers*. Shawne D. Miksa, Chair, August 1, 2011. University of North Texas, Committee Member.

#### **Dissertation Proposals at Other Institutions**

Schwartz, Brian *More than a Look-up Skill: Medical Information Literacy Education in Osteopathic Medical Schools*. D. Mirah Dow, Chair, December 4, 2015. Emporia State University, Committee Member.

Snow, Karen. *A Study of the Perception of Cataloging Quality among Catalogers*. Shawne D. Miksa, Chair, May 11, 2010. University of North Texas, Committee Member.

#### **Master's Thesis at the University of Denver**

Hemingson, Jeff. *Recital Paper*. Lamont School of Music, February 2010, Outside Chair.

#### **Capstones at the University of Denver**

Anthony, Alisa. *Correlation of Library and Information Science Program outcomes and Vacant Position Qualifications Listed on the Colorado State Library Jobline by Employers During the Period September 1, 2000 through August 31, 2002*. Chair, Winter Quarter, 2003.

Borden, Donna M. *Improving Emergency Communications Systems: Is a Radio Communications Network the Answer?* Fall Quarter, 2014.

Bowden, Heather L.M. *Exploring Biological Models for Long-term Data Preservation*. Chair, Spring Quarter, 2008.

Casenada, Cassandra Y. *Challenges to the Recruitment, Education, and Retention of Librarians of Color*. Chair, Spring Quarter, 2008.

Chang, Jennifer C. *Legal Research Practice and Preference: A Law Firm Perspective*. Chair, Spring Quarter 2011.

Ellis, Megan S. Fitzgerald. *Design of a Public Library Adult Volunteer Recruitment Program and Training Curriculum*. Chair, Winter Quarter, 2003.

Kircher, Kathy. *Development of a Library Pathfinder for Exobiology and Posting it on the Internet*. Chair, Winter Quarter, 2003.

Melhado, Loretta. *Design of St. John's Episcopal Church Library*. Chair, Spring Quarter, 2008.

Radcliff, Kathy. *Original Cataloging of Archival materials in the HERS Collection in Penrose Library*. Chair, Winter Quarter, 2003.

Sass, Carol Ann. *ACT Periodical Index: Access to Catholic Thinking Periodical Index: Web Index to Select Catholic Periodicals*. Spring Quarter 2000.

Stone, Sergio D. *Conducting Community Analysis for the Bemis Public Library (Littleton, Colorado) Using 2002 U.S. Census Data and the Online Outcome-Based Evaluation Toolkit*. Chair, Winter Quarter, 2003.

Tureson, Tamara. *Design and Use of an Information Audit Tool for Use in a Law Library*. Chair, Winter Quarter, 2003.

Tweed, Beth. *Evaluation of Email Reference Service in a Consumer Health Library Environment*. Chair, Winter Quarter, 2003.

## GRANTS AND CONTRACTS

*Student Learning in Agriculture STEM through Teacher Professional Development.* Research team: Stanton Gartin (PI) and Cyndi Hofmeister, Northeast Junior College; Jeff Cash, Cheryl Sánchez, Anne-Marie Crampton, Lamar Community College; Suzanna Spears, Morgan Community College; Jack Wiley, Kerry Gabrielson, Trinidad State Junior College; Michael J. Miller, Colorado State University; Michael Womochil (Co-PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Agriculture, Agriculture and Food Research Initiative, Food, Agriculture, Natural Resources and Human Sciences Education and Literacy Initiative, \$404,460 (2017-2020)

*Leading and Achieving: the Colorado Agriculture Regional Consortium.* Research team: Jack Wiley (PI), Kerry Gabrielson, Trinidad State Junior College; Jeff Cash (PI), Cheryl Sánchez, Anne-Marie Crampton, Lamar Community College; Suzanna Spears, Morgan Community College; Cyndi Hofmeister, Northeast Junior College; Michael Womochil (Co-PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Agriculture, Hispanic Serving Institutions Education Grants Program, \$504,414 (2017-2020)

*Cyber Prep Program Planning Grant.* Research team: Debbie Sagen (PI), Brenda Lauer, Pikes Peak Community College; Gretchen Martin, Koiosa Insights; and, Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Commerce, Regional Alliances and Multi-stakeholder Partnerships to Stimulate (RAMPS) Cybersecurity Education and Workforce Development, \$199,681 (2016-2018)

*Career and Technical Education in Colorado: Pathways to Education and Employment.* Research team: Heather McKay (PI), Rutgers University; Sarah Heath, Casey Sacks, Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Education, Institute of Education Sciences, \$1,400,000 (2017-2021)

*Pre-Alliance Planning Grant Colorado Community College Alliance.* Research team: Victor Vialpondo (PI) and Janel Highfill, Community College of Aurora; Heidi Loshbaugh (Co-PI), Community College of Denver; Rick Reeves, Bill McGreevy, Liz Cox, and Kristin Aslin, Red Rocks Community College; Cathy Pellish, Front Range Community College; Samuel DeVries, Arapahoe Community College; Sylvia D. Hall-Ellis, Colorado Community College System. National Science Foundation, Louis Stokes Alliance for Minority Participation (LSAMP), \$86,817 (2016-2017)

*Towards Scalable Differentiated Instruction Using Technology-enabled, Competency-based, Dynamic Scaffolding.* Research team: Karen Wilcox (PI) and Vijay Kumar, Center for Computational Engineering, Massachusetts Institute of Technology; Flora McMartin, Broad-based Knowledge; Quinsigamond Community College; and, Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Education, First in the World Developmental Grant, \$2,891,882 (2015-2019)

*Colorado Strategic Partnerships Emergency Grant.* Research team: Elise Lowe-Vaughn (PI), Amy Hodson, Celia Hardin, Barbara McBride, James Newby, Christopher Dewhurst, Nina Holland, Kate Anderson, MaryAnn Roe, Chrystalynn Chrystalynn, Elaine Edon, Mona Barnes, Tom Morgan, Rob Hanni, and Marie Valenzuela, Colorado Department of Labor and Employment; Steve Anton, Joelle Brouner, and, Katie Griego, Colorado Department of Human Services; Rebecca Holmes, Judith Martinez, and Jennifer Jirous, Colorado Department of Education; Emily Templin Lesh, Colorado Workforce Development Council; Cory Everett, Colorado Department of Regulatory Agencies; and, Casey Sacks and Sylvia D. Hall-Ellis, Colorado Community College System. U.S. Department of Labor, Strategic Partnerships Emergency Grant, \$5,000,000 (2015-2017)

*CAEL Jump Start Program: Competency-Based Education.* Research team: Jerry Migler (PI), Casey Sacks, Debra Cohn, Thomas Hartman, and Sylvia D. Hall-Ellis, Colorado Community College System; Matt Jamison, Front Range Community College; Mike Coste, Red Rocks Community College; Amanda Corum, Pueblo Community College; Janet Colvin, Pikes Peak Community College; and, MaryAnn Matheny, Community College of Denver. Council for Adult and Experiential Learning, \$15,000 (2015)

*Summit on the Redesign of Developmental Education.* Research team: Jerry Migler (PI), Casey Sacks, and Sylvia D. Hall-Ellis, Colorado Community College System; Chip Nava, Pueblo Community College; Kim Moultny, Arapahoe Community College; Debbie Ulibarri, Trinidad State Junior College; and, Kris Bernard, Front Range Community College. American Association of Community Colleges, \$15,000 (2015-2016)

*Equity in Excellence at Colorado Community Colleges.* Research team: Keith Howard (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Estela Mata Bensimon, Center for Urban Education, University of Southern California; and Kerry Gabrielson, Trinidad State Junior College. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$150,000 (2015-2016)

*MBA High School of Business in Colorado.* Research team: Laurie Urich (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Rudolph Sumpter and Beatrice Gerrish, Boulder Valley Schools; Keith Curry Lance, RSL Research Group. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$501,295 (2015-2016)

*Fullbridge Program in Colorado.* Research team: Keith Howard (PI) and Sylvia D. Hall-Ellis, Colorado Community College System; Suzanna Spears, Fort Morgan Community College; and, Cheryl Sánchez and Anne-Marie Compton, Lamar Community College. Colorado Department of Higher Education, Colorado Opportunity Scholarship Program, \$300,000 (2015-2017)

*Colorado Community College System Alternative Credit Program.* Research team: Jerry Migler (PI), Keith Howard, and Sylvia D. Hall-Ellis, Colorado Community College System. American Council on Education, \$13,000 (2015)

*Internationalization in Higher Education.* Researcher: Samuel D. Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$8,000 (2014-2015)

*International Perspectives on Bilingual Education.* Researcher: Sharolyn Pollard-Durodola. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$3,700 (2014-2015)

*Cultivating Culturally Relevant and Responsive Curriculum and Pedagogy in College.* Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, iRise Grant, \$5,000 (2014-2015)

*Project EMERGE (Educational Model for Evaluation and Replicability in Gifted Environments).* Research team: Norma Hafenstein (PI) and Bruce Uhrmacher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Lynde and Harry Bradley Foundation, \$235,000 (2014-2015)

*Collecting Asian American Refugee Stories.* Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. American Educational Research Association, Research Grant, \$5,000 (2014-2015)

*Developing Expertise in Teaching K-5 Mathematics.* Research team: Julie Sarama (PI) and Douglas H. Clements (Co-PI), in partnership with the School of Education at the University of Michigan. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$130,344 (2013-2015)

*Investigation of the Long-Term Outcomes for Special Education Students.* Researcher: Antonio Olmos-Gallos. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Jefferson County School District, Office of Assessment, \$40,000 (2014)

*Refugee Community Collaboration.* Researcher: Vicki Tomlin (PI) in partnership with the African Community Center and Jewish Family Service. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$14,854 (2014-2015)

*Access to Mathematics for All.* Research team: Richard S. Kitchen (PI), Nicole M. Russell (Co-PI), and Terrence Blackman (Co-PI), Curriculum Studies and Teaching Program, Morgridge College of Education; Álvaro Árias (Co-PI, Department of Mathematics); and, James Gray (Co-PI), Department of Mathematics, Community College of Aurora. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, The Robert Noyce Scholarship Program, Capacity Building Project, \$349,926 (2014-2016)

*Cognitive Test Battery for Intellectual Disabilities.* Research team: Karen Riley (PI), Lyndsay Agans, Jessica Lerner, and Karin Dittrick-Nathan in partnership with David Hessel (PI), The MIND Institute at the University of California – Davis, and Elizabeth Berry-Kravis, Rush University Medical Center. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Institutes of Health, Outcome Measures for Use in Treatment Trials for Individuals with Intellectual and Developmental Disabilities (R01), \$2,499,996 (\$588,672 at DU) (2014-2019)

*Broadening Participation in Engineering among Women and Latino/as: A Longitudinal, Multi-Site Study.* Researcher: Patton Garriott (PI) in partnership with the University of North Dakota and the University of Missouri. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, HER Core Research, \$677,390 (\$69,992 at DU) (2014-2019)

*Designing a Teacher Evaluation System to Improve Teacher Effectiveness for Culturally and Linguistically Diverse Learners.* Research team: María del Carmen Salazar (PI), Jessica Lerner, and Kathy Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$29,988 (2014-2016)

*Developing a College-Going Culture in Latina/O Families: Exploring the Influence of Funds of Knowledge on Family Outreach Programs.* Researcher: Judy Marquez Kiyama. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$18,720 (2014-2016)

*Assessment of Quality of Life in Neural Implantation Surgery for the Treatment of Parkinson's Disease.* Researcher: Cynthia McRae. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$3,967 (2014-2015)

*Pura Vida: Cloud Forest, Curriculum and Cross-Cultural Study.* Research team: Norma Hafenstein (PI) and Bruce Uhrmacher (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$8,000 (2014-2015)

*Online Course Development for Curriculum and Instruction.* Researcher: Ruth Chao. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

*Online Course Development for Curriculum and Instruction.* Researcher: María del Carmen Salazar. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

*Online Course Development for Curriculum and Instruction.* Researcher: Jessica Lerner. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

*Online Course Development for Curriculum and Instruction.* Researcher: Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2014)

*The Mathematics Education of African Americans, 1866 – 1954.* Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Academy of Education, Spencer Foundation Postdoctoral Fellowship, \$55,000 (2014-2016)

*Early Childhood Care and Education Study*. Research team: Carrie Germeroth (PI), Melissa Mincic, and Douglas H. Clements. Technical reviewer for MCE: Sylvia D. Hall-Ellis. State of North Dakota, Department of Public Instruction, \$73,500 (2013-2014)

*Graduate Level Specialty in Addiction Counselor Training with Emphasis on Integration of Native American Specific Content*. Research team: Ruth Chao (PI) and Michael J. Faragher (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. The Galena Foundation, \$289,732 (2013-2016)

*The Collecting Asian American and Pacific Islander Refugee Stories (CARS) Project*. Researcher: Samuel Museus. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$15,000 (2014)

*Parents in Transition: A Multiple Case Study of Parent and Family Orientation Programs*. Researcher: Judy Marquéz Kiyama. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$1,500 (2014-2015)

*The Sistah Network: Black Women Graduate Students Supporting and Retaining Each Other*. Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,708 (2014-2015)

*Evaluation of the Northeast Denver Babies Ready for College Program*. Research team: Carrie Germeroth (PI), Melissa Mincic, and Douglas H. Clements. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High Montessori, \$9,922 (2013-2014)

*Developing Teaching Expertise in K-5 Mathematics*. Research team: Julie Sarama (PI) and Douglas Clements (University of Denver), in partnership with Timothy Boerst (PI), Meghan Shaughnessy, Deborah Ball, Hyman Bass (School of Education at the University of Michigan). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$449,827 (\$130,344 at the University of Denver) (2013-2015)

*Early Learning Care and Education Study Program Grant for the State of North Dakota*. Research team: Carrie Germeroth (PI), Melissa Mincic, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. State of North Dakota Department of Public Instruction, \$73,500 (2013-2014)

*Local Professional Learning Community for School Leaders*. Research team: Susan Korach (PI), Kristina Hesbol, and Rebecca McClure. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Education Development Center, \$10,950 (2013)

*Healthy Eaters, Lifelong Movers 2: Implementing Evidence-Based School Environment, Policy, and Curricular Changes to Increase Opportunities for Healthy Eating and Physical Activity in Low Income, Rural Colorado*. Research team: Elaine Berlansky, University of Colorado at Denver (PI), Nicholas Cutforth, University of Denver (Co-PI), and Allison Reeds. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$3,103,108 (2013-2017)

*Hughes Rare Books Library Room Renovation in the Sturm College of Law*. Project team: Patti H. Marks, Sylvia D. Hall-Ellis, and Leigh Elliott. Mabel T. Hughes Charitable Trust, \$34,000 (2013-2014)

*The Promise Center Partnership with the Marsico Institute for Early Learning and Literacy and the City and County of Denver*. Research team: Karen Riley (PI), Douglas H. Clements (Co-PI), and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. The Piton Foundation, \$223,468 (2013-2014)

*Center of Excellence for Problem Gambling*. Research team: Ruth Chao (PI) and J. Mike Faragher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$68,021 (2012-2013)

*United Way Implementation and Validation Review*. Research team: Douglas H. Clements (PI), Amanda Moreno, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High United Way, \$19,737 (2013)



*Math/Science Partnership in Rural Districts.* Research team: Kristen Bunn (PI, Eagle County Schools), Paul Michalec (Co-PI), and Alegra Reiber. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Education, Colorado's Mathematics and Science Partnership Program, \$750,000 (2013-2014)

*Mathematics and Science Education of African Americans.* Research team: Nicole Russell (PI), Sylvia D. Hall-Ellis, Steve Fisher (Penrose Library). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$29,994 (2013-2015)

*Online Course Development for Curriculum and Instruction.* Researcher: Nicole Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$3,000 (2013)

*Discourse and Opportunity: Undocumented Students and Higher Education Policy.* Researcher: Ryan Gildersleeve. Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Academy of Education, Spencer Foundation Postdoctoral Fellowship, \$55,000 (2012-2014)

*An Anthropological Study of the Latino Graduation Ceremony.* Researcher: Ryan Gildersleeve. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Spencer Foundation, \$39,900 (2012-2013)

*Fragile-X and Pharmaceutical Company: Clinical Trial of AFQ056.* University of California – Davis Children's Hospital MIND Institute (Sacramento), Children's Hospital Denver, and Rush Children's Hospital at Rush University Medical Center (Chicago). Karen Riley, PI. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Novartis Pharmaceuticals Corporation, \$394,206 (2012-2014)

*Project Engage, Phase 2, a DAPRA Grant in partnership with Total Immersion Systems, Inc., and Texas A&M University.* Research team: Karen Riley (PI) and Lyndsay Agans (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Defense, \$60,000 (2011-2013)

*International School Psychology Practicum Exchange.* Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$14,951 (2012-2013)

*Online Course Development for Curriculum and Instruction.* Research team: Bruce Uhrmacher (PI) and Norma Hafenstein (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Teaching and Learning, \$18,193 (2012-2014)

*Writers in the Schools.* Research team: Karen Riley (PI) and Amanda Moreno (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Humanities, \$4,965 (2012-2013)

*Learning Ecosystem Validation Grant.* Research team: Karen Riley (PI), Lyndsay Agans, Kent Seidel, and Shimelis Assefa. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Bill & Melinda Gates Foundation, \$315,000 (2012-2013)

*Project Words of Oral Reading and Language Development (WORLD).* Research team: Jorge E. Gonzalez (PI), Texas A&M University; Laura Saenz (Co-PI), University of Texas – Pan American; and, Sharolyn Pollard-Durodola (Co-PI), University of Denver. Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$53,354 (2012-2015); award \$640,718, transfer from Texas A&M University

*Increasing the Efficacy of an Early Mathematics Curriculum with Scaffolding Designed to Promote Self-Regulation.* Research team: Douglas H. Clements (PI) and Julie Sarama (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$1,445,315 (2008-2014); award \$4,541,975, transfer from University at Buffalo, The State University of New York

*Using Rule Space and Poset-based Adaptive Testing Methodologies to Identify Ability Patterns in Early Mathematics and Create a Comprehensive Mathematics Ability Test.* Research team: Douglas H. Clements (PI) and Julie Sarama (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$323,791 (2010-2014); award \$1,194,944, transfer from University at Buffalo, The State University of New York

*Comprehensive Postdoctoral Training in Scientific Education Research.* Researcher: Julie Sarama (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Education, Institute of Education Sciences, \$133,458 (2010-2014); award \$613,353, transfer from University at Buffalo, The State University of New York

*Longitudinal Study of a Successful Scaling Up Project: Extending TRIAD.* Research team: Douglas H. Clements (PI), Julie Sarama (Co-PI), and Abt Associates (Carolyn Layzer, Fatih Unlu, Laurie Bozzi, Lily Fesler, Alina Martinez, Cristofer Price, James van Orden). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Institute of Education Sciences, \$384,940 (2011-2015; award \$1,250,286, transfer from University at Buffalo, The State University of New York

*Early Childhood Education in the Context of Mathematics, Science, and Literacy.* Research team: Julie Sarama (PI), Douglas H. Clements (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. National Science Foundation, \$990,020 (2010-2014; award \$2,285,228, transfer from University at Buffalo, The State University of New York

*Early Childhood Clearinghouse Information Center Redesign.* Research team: Karen Riley (PI) and Amanda Moreno (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Office of the Lt. Governor of Colorado, \$12,000 (2012-2013)

*Morgridge Rural Educational Leadership Initiative.* Research team: Lyndsay Agans (PI), Linda Brookhart (Co-PI), Susan Korach, and Rebecca McClure. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Morgridge Family Foundation, \$100,000 (2012-2014)

*Center of Excellence for Problem Gambling.* Research team: Patrick Sherry (PI) and J. Mike Faragher. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$55,000 (2012-2013)

*Intermodal Transportation Institute Research Initiatives.* Researcher: Patrick Sherry. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University Transportation Centers Program, Research and Innovative Technology Administration, U.S. Department of Transportation. \$600,000 (2012-2014)

*Mile High United Way Social Innovation Fund Early Literacy Initiative.* Gloria L. Miller, PI, Amanda Moreano, Kim Hartnett-Edwards, and Sheridan Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Mile High United Way, \$89,992 (2012-2013)

*International School Psychology Practicum Exchange.* Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, \$1,000 (2012-2013)

*Refugee Student Art Outreach.* Researcher: Karin Dittrick-Nathan. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$3,000 (2012-2013)

*Resistance, Resilience, and Reciprocity: Centering the Voices of Black Doctoral Women with Faculty Aspirations.* Researcher: Nicole M. Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,965 (2012-2013)

*Assessing Learning through Student Notebooks.* Research team: Keith Miller, Nancy Sasaki, and Kathy Green. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Professional Research Opportunities for Faculty, \$30,000 (2012-2014)

*International School Psychology Practicum Exchange*. Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$2,000 (2012-2013)

*ELO in Colorado*. Research team: Cynthia Hazel and Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Legacy Foundation, \$150,000 (2012-2013)

*Creating Online LIS Courses*. Research team: Mary C. Stansbury (PI), Shimelis Assefa, Denise Anthony, Xiao Hu, and Krystyna Matusiak. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$15,000 (2011-2013)

*Maritime Piracy Seminar*. Researcher: Ved Nanda, The Nanda Center, Sturm College of Law. Technical reviewer for Sturm College of Law: Sylvia D. Hall-Ellis. Arsenault Family Foundation, \$15,000 (2012-2013).

*Early Childhood Librarianship: An Interdisciplinary, Experiential Learning MLIS*. Researcher: Mary C. Stansbury (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Laura Bush's 21st Century Librarians Program, Institute for Museums and Library Services, \$249,066 (2012-2014)

*Learning Ecosystem Planning Grant*. Research team: Karen Riley (PI), Lyndsay Agans, Kent Seidel, and Shimelis Assefa. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Bill & Melinda Gates Foundation, \$281,217 (2011-2012)

*Advanced Service Learning Practitioner Faculty Grant*, Sylvia D. Hall-Ellis, University of Denver, Center for Community Engagement and Service Learning, \$400 (2011)

*Evaluating and Enhancing the EspeciallyMe Program*. Research team: Lori D. Patton and Nicole Russell. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, Public Good Fellowship Grant, \$24,780 (2012)

*Choosing Excellence: Let Every Child Bloom*. Research team: Shimelis Assefa (PI) and Mary C. Stansbury (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Community Engagement and Service Learning, Public Good Grant, \$7,657 (2012)

*K-8 STEM Content Specific Professional Development to Improve Elementary Student Achievement*. Research team: Kent Seidel (PI), Nicole Russell (Co-PI), Kimberly Hartnett-Edwards, Paul Michalec, Jeff Farmer, Keith Miller, Alegra Reiber, and Nancy Sasaki. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Education, Improving Teacher Quality Grant, (Title II ESEA), \$307,299 (2011-2012)

*Building a Better Principal Pipeline to Boost Student Achievement*. Researcher: Susan Korach. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Denver Public Schools; a subcontract from the Wallace Foundation Grant, \$170,000 (2011-2017)

*Center of Excellence for Problem Gambling*. Research team: J. Mike Faragher (Co-PI) and Bobbie Vollmer (PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Department of Behavioral Health, \$79,999 (2011-2012)

*An Exploration of Novice Teachers' Core Competencies: Impacts on Student Achievement, and Effectiveness of Preparation*. Research team: Kent Seidel (PI), Kathy Green (Co-PI), Kimberly Hartnett-Edwards, and Duan Zhang. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Institute of Education Sciences, Effective Teachers and Effective Teaching, \$990,987 (2012-2015)

*Project Engage, a DAPRA Grant in partnership with Total Immersion Systems, Inc., and Texas A&M University*. Research team: Karen Riley (PI) and Lyndsay Agans (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. U.S. Department of Defense, \$49,964 (2011-2014)

*User-centered Evaluation of Music Search Engines.* Researcher: Xiao Hu. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Faculty Research Fund, \$2,931 (2011-2012)

*Educational Practicum in Vietnam and China to Promote the Inclusion of Young Children with Disabilities.* Researcher: Gloria L. Miller. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Office of Internationalization, \$5,000 (2011-2012)

*Evaluation of Colorado's Enhancing Quality in Infant-Toddler (EQIT) Initiative.* Research team: Virginia R. Maloney and Amanda Moreno. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Buell Foundation, \$395,884 (2011-2013)

*Creating Engaging Environments to Teach Pre-Algebra Mathematics to Elementary Students.* Research team: Álvaro Arias, Mario López, María del Carmen Salazar, and Lyndsay Agans. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver Interdisciplinary Grant, \$60,000 (2011-2012)

*Morgridge Education Technology Accessible (META) Resource Project.* Research team: Lyndsay Agans (PI) and Shimelis Assefa (Co-PI). Technical reviewer for MCE: Sylvia D. Hall-Ellis. Morgridge Family Foundation, \$36,000 (2011)

*MCE Connect: A 21<sup>st</sup> Century Framework for Faculty Development.* Research team: Bruce Uhrmacher (PI), Shimelis Assefa (Co-PI), Lyndsay Agans (Co-PI), Kimberly Hartnett-Edwards, Norma Hafenstein, Xiao Hu, Paul Michalec (Co-PI), María del Carmen Salazar (Co-PI), and Sandra Snyder-Mondragon. Technical reviewer for MCE: Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$22,355 (2011-2012)

*Parent Education and Parent Leadership and Advocacy.* Research team: Virginia Maloney (PI) and Amanda Moreno, Marsico Institute for Early Learning and Literacy. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$27,358 (2010-2011)

*Intentional School Culture.* Researcher: Cynthia Hazel. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Denver Public Schools, \$38,040 (2010-2011)

*Healthy Eaters, Lifelong Movers: Implementing Evidence-Based School Environment, Policy, and Curricular Changes to Increase Opportunities for Healthy Eating and Physical Activity in Low Income, Rural Colorado.* Research team: Elaine Berlansky, University of Colorado at Denver (PI), Nicholas Cutforth, University of Denver (Co-PI), and Allison Reeds. Technical reviewer for MCE: Sylvia D. Hall-Ellis. Colorado Health Foundation, \$1,683,277 (2011-2014)

*Second Life Learning Community.* Research team: Don McCubbrey (PI), Sylvia D. Hall-Ellis (Co-PI), Walter LaMendola, and Paul Novak. University of Denver, Center for Teaching and Learning, \$13,000 (2010-2011)

*Reintroducing the Value of Law Librarians to Academic and Public Librarians in Colorado through the Identification and Use of Emerging Technologies.* Research team: Sylvia D. Hall-Ellis (Co-PI), Stacey L. Bowers (PI), and Christopher Hudson, in partnership with Denver Public Library, Arapahoe Library District, and the Colorado State Supreme Court Library. University of Denver, Center for Community Engagement and Service Learning, \$5,773 (2010-11)

*Reintroducing the Value of Law Librarians to Public Librarians through the Identification and Use of Emerging Technologies and Resources.* Research team: Stacey Bowers (PI) and Sylvia D. Hall-Ellis (Co-PI). American Association of Libraries, Wolters Kluwer Law & Business Grant Program, \$2,725 (2010-2011)

*Faculty Service Learning Pod.* Research team: María del Carmen Salazar and Nicholas Cutforth (Curriculum and Instruction Program), Frank Tuitt (Higher Education Program), Cynthia Hazel and Gloria Miller (Child, Family, and School Psychology Program), and Sylvia D. Hall-Ellis (Library and Information Science Program). University of Denver, Center for Community Engagement and Service Learning, \$8,000 (2010-2011)

*Lincoln Collaborative.* Research team: Antonio Esquibel (Principal, Lincoln High School), María del Carmen Salazar (Curriculum and Instruction Program), and. Sylvia D. Hall-Ellis. School Improvement Grant, Denver Public Schools, \$375,000 (2010-2012)

*Future LEADers of America: Leaders III.* Research team: Denver Public Library (Kristen Svendsen, PI), the University of Denver (Sylvia D. Hall-Ellis), the Colorado Chapter of REFORMA (Orlando Archibeque), and the Colorado Association of Libraries (Martin Garnar). Laura Bush's Recruiting Librarians for the 21<sup>st</sup> Century Program, Institute for Museums and Library Services, \$988,366 (2009-2012)

*Teaching for Success in the Library Environment: LIS 4030 in Library 2.0.* Research team: Deborah S. Greal (PI) and Sylvia D. Hall-Ellis (Co-PI). University of Denver, Center for Teaching and Learning, \$ 9,350 (2009-10)

*Writing Group Faculty Grant,* Sylvia D. Hall-Ellis, University of Denver, Center for Community Engagement and Service Learning, \$750 (2008-2009)

*Collaborative Learning Faculty Grant,* Sylvia D. Hall-Ellis, University of Denver, Center for Teaching and Learning, \$1,500 (2008)

*Connecting Information Literacy to Learning.* Research team: Lori Micho, Merrie Valliant, Amanda Samland, and Sylvia D. Hall-Ellis. Colorado State Library, LSTA Discretionary Grant Program, \$19,548 (2008-2009)

*Law Librarianship Fellows Program.* Research team: Sylvia D. Hall-Ellis (PI), Stacey Bowers (Co-PI), and Christopher Hudson, Westminster Law Library. Laura Bush's 21<sup>st</sup> Century Librarians Program, Institute for Museums and Library Services, \$999,370 (2008-2012)

*Grant Writing in a Cooperative Learning Environment.* Sylvia D. Hall-Ellis. University of Denver, Center for Teaching and Learning, \$2,000 (2008-2009)

*Project Homeless Connect 6 Event Evaluation.* Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$9,785 (2008)

*Project Ecuador: International Learning Service Libraries – A Faculty Development Experience in Ecuador.* Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$600 (2007)

*Project Ecuador: International Learning Service Libraries – A Faculty Development Experience in Ecuador.* Sylvia D. Hall-Ellis, International Service Learning Office, University of Denver, \$400 (2007)

*Project Homeless Connect 5 Event Evaluation.* Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$1,000 (2007)

*Project Homeless Connect 4 Event Evaluation.* Research team: Sylvia D. Hall-Ellis and Duan Zhang. University of Denver Center for Community Engagement and Service Learning, \$4,595 (2007)

*Future LEADers of America: Leaders II.* Research team: Denver Public Library (Kristen Svendsen, PI), the University of Denver (Sylvia D. Hall-Ellis), and the Colorado Chapter of REFORMA (Orlando Archibeque). Laura Bush's Recruiting Librarians for the 21<sup>st</sup> Century Program, Institute for Museums and Library Services, \$988,518 (2007-2010)

*Strategic Planning Assistance for the Denver Medical Library.* Sylvia D. Hall-Ellis. Denver Medical Library, Inc., \$30,000 (2006-2007)

*Destiny Software for JMAC Student Lab.* Sylvia D. Hall-Ellis, gift from the Sagebrush Corporation, Minneapolis, Minnesota, \$10,000 (2006)

*Libraries: Tools for Education and Development Worldwide: A Faculty Development Experience in France.* Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$800 (2005)

*Denver Public Library: Opportunities for Change.* Sylvia D. Hall-Ellis, Colorado Community Based Research Network, \$2,000 (2005)

*Future LEADers of America.* Research team: Denver Public Library (Letty Icolari and Steve Taylor, PIs), Emporia State University (Jim Agee), and the University of Denver (Sylvia D. Hall-Ellis). Recruiting Librarians for the 21<sup>st</sup> Century Program, Institute for Museums and Library Services, \$670,315 (2005-2008)

*American Association of University Professors Summer Institute Professional Development Grant.* Sylvia D. Hall-Ellis, American Association of University Professors, \$300 (2005)

*Beta Phi Mu Alumni Tea.* Sylvia D. Hall-Ellis, gift from the Office of Alumni and Parent and Relations, University of Denver, \$2,000 (2005)

*Spectrum Software for LIS Student Lab.* Sylvia D. Hall-Ellis, gift from the Sagebrush Corporation, Minneapolis, Minnesota, \$5,000 (2005)

*Developing Research Capacity in Community Organizations and Residents through Training and Technical Assistance.* Nicholas J. Cutforth (PI) and Sylvia D. Hall-Ellis. Piton Foundation, \$25,000 (2005-2006)

*Libraries: Tools for Education and Development Worldwide: A Faculty Development Experience in Argentina.* Sylvia D. Hall-Ellis, Office of Internationalization, University of Denver, \$500 (2004)

*Developing Research Capacity in Community Organizations and Residents through Training and Technical Assistance.* Research team: Nicholas J. Cutforth (PI), Gary Lichtenstein and Sylvia D. Hall-Ellis, Piton Foundation, \$25,000 (2003-2004)

*Increasing Spanish-Speaking and Hispanic Diversity among Library and Information Science Students at the University of Denver: Development of a Student Recruitment Model.* Researcher: Sylvia D. Hall-Ellis (PI), Office of Multicultural Excellence, University of Denver, \$2,750 (2003-2004)

*Collection Development Enrichment to Support the Cataloging & Classification Specialization and School Librarianship within the Library & Information Science Program at the University of Denver.* Research team: Sylvia D. Hall-Ellis (PI) and Deborah S. Grealy. Women's Library Association, University of Denver, \$4,000 (2003)

*Collection Development Enrichment to Support the Library & Information Science Program at the University of Denver.* Research team: Deborah S. Grealy (PI) and Sylvia D. Hall-Ellis. Women's Library Association, University of Denver, \$4,000 (2001)

*Wireless LAN for Library Education.* Research team: Deborah S. Grealy (PI) and Sylvia Hall-Ellis. University of Denver, Center for Teaching and Learning, \$24,000 (2001-2002)

*Upward Bound – A Program for South Texas Youth.* Research team: Monte Churchill, Executive Director of Community Relations; Gary R. Saucedo, Outreach Coordinator; Raymond Hernandez, (PI) Associate Dean for Student Success; and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). U.S. Department of Education, Office of Postsecondary Education, \$2,672,003 (1999-2003)

*Write Now! Improving Elementary Students' Writing Skills.* Research team: Caryl G. Thomason, Assistant Superintendent (PI); Karen Tankersley, Principal; and, Hal Anderson, Director of Technology, Cheyenne Mountain School District 12 (Colorado Springs, Colorado); and Sylvia D. Hall-Ellis. Colorado Department of Education, Educational Telecommunications Unit, \$189,453 (1999-2001)

*Operation Quick Start -- Distance Learning in Rural Colorado.* Research team: Randal Weigum, Technology Coordinator (PI); Bonnie Barns, Director of Federal Programs and Staff Development; and, Adam "Joe" Raskop, Executive Director, Southeastern Board of Cooperative Educational Services (Lamar, Colorado); and Sylvia D. Hall-Ellis. Colorado Department of Education, Educational Telecommunications Unit, \$400,000 (1999-2001)

*Advanced Technological Training for Information Professionals for the 21<sup>st</sup> Century.* Research team: Mario Reyna, Division of Business Director (PI) and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). Phi Delta Kappa and the National Science Foundation, \$250,000 (1999-2001)

*Working Connections – Training Information Technologies Professionals for the 21<sup>st</sup> Century.* Research team: Mario Reyna, Division of Business Director (PI) and Sylvia D. Hall-Ellis, South Texas Community College (McAllen, Texas). Microsoft Corporation and the American Association of Community Colleges, \$1,147,775 (1999-2001)

*The ROAD (Research Oriented Amplification of Development to Literacy) Program.* Research team: Deborah J. Leong (PI), Metropolitan State University; Elena Bodrova, Metropolitan State University; Dmitri Semenov, Robert J. Marzano, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Foundation, \$25,000 (1998-1999)

*Press to Literacy.* Research team: Deborah J. Leong (PI), Metropolitan State University; Elena Bodrova, Metropolitan State University; Dmitri Semenov, Robert J. Marzano, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). The Denver Post and the Robert S. McCormick Foundation, \$49,818 (1998-1999)

*International Telementor Center.* Research team: David Neils, David B. Frost (PI), and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Philanthropy, \$100,000 (1998-1999)

*America Reads: Providing Tutor Training for the America Reads Challenge.* Research team: Louis F. Cicchinelli (PI) and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Department of Education, Office of Educational Research and Improvement, \$306,000 (1998-1999)

*Comprehensive School Reform.* Research team: Louis F. Cicchinelli (PI), J. Timothy Waters, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Department of Education, Office of Educational Research and Improvement, \$285,000 (1998-1999)

*Sustainable Energy Education (SEE) Program for Grades 4-8: Preparing Today's Youth for Lifelong Learning and Responsible Actions in Energy Conservation.* Research team: Mary Gromko, Colorado Department of Education; Gene McCarthy, Rocky Flats Field Office, U.S. Department of Energy; Gina Kissell, National Renewable Energy Laboratory; and Barbara L. McCombs (PI), Janet L. Bishop, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). State of Colorado Governor's Office for Energy Conservation, \$499,936 (1997-1999)

*Review of Kansas Curriculum Standards in Mathematics and Language Arts.* Research team: Robert J. Marzano (PI), John S. Kendall, David B. Frost, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Submitted to the Kansas State Department of Education, \$25,903 (1998)

*International Telementor Center.* Research team: David Neils, John Kuglin, Chris Rapp, David B. Frost (PI), and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). Hewlett-Packard Company, \$54,752 (1998)

*Genesis Mission: Education Public Outreach.* Developed in partnership by the Jet Propulsion Laboratory, California Institute of Technology, Los Alamos National Laboratory, Lockheed Martin Astronautics, and the Mid-continent Regional Educational Laboratory (Aurora, Colorado). Research team: John T. Sutton (PI), Alice Krueger, Martha Henry, Greg Rawls, Shae Isaacs, Jeff Johnson, Deb Jordan, Arlene Mitchell, David B. Frost, Jana Caldwell, J. Timothy Waters, and Sylvia D. Hall-Ellis. National Aeronautics and Space Administration, \$139,700,000; subcontract award, \$4,750,000 (1997-2007)

*North Dakota Mathematics Assessment Project.* Developed in partnership by the North Dakota Department of Education and Mid-continent Regional Educational Laboratory (Mid-continent Regional Educational Laboratory). Research team: Ann Clapper, Clarence Bina, Greg Gallagher, North Dakota Department of Education; Don Burger (PI), Hillary Michaels, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Office of Education, \$1,618,214; subcontract award, \$389,076 (1997-2001)

*Pacific Resources for Education and Learning Distance Education: Project Evaluation.* Developed in partnership by the Pacific Educational Community, the Pacific Resources for Education and Learning (PREL), and Mid-continent Regional Educational Laboratory (McREL). Research team: John W. Kofel (PI), Executive Director, PREL; J. Timothy Waters, Executive Director; Joan Buttram, Robert Keller, and Sylvia D. Hall-Ellis, Mid-continent Regional Educational Laboratory (Aurora, Colorado). U.S. Office of Education, Star Schools Program, \$10,000,000; subcontract award, \$500,000 (1997-2002)

*Identification of Bilingual Gifted and Talented Children: A Comprehensive School Grants for Bilingual Education.* Developed in partnership by Hidalgo (Texas) ISD, Los Fresnos (Texas) CISD, Progreso (Texas) ISD, University of Texas – Pan American (Edinburg, Texas), and Education Service Center, Region One (Edinburg, Texas). Research team: Hilda Medrano, Dean, College of Education, University of Texas – Pan American; Linda Phemister (PI), Janie Navarro, and Sylvia D. Hall-Ellis, Education Service Center, Region One. U.S. Department of Education, Office of Bilingual Education and Minority Languages Affairs, \$1,670,633 (1997-2002)

*Academics 2000: First Things First -- The Texas Goals 2000.* Developed for Jim Hogg (Hebbronville, Texas) County ISD, Mirando City (Texas) ISD, and San Isidro (Texas) ISD. Research team: Hilda Medrano, Dean, College of Education, University of Texas - Pan American (Edinburg, Texas); Angie Lehmann, Amy Mares, Ellen Gonzalez (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg, Texas). Texas Education Agency, \$339,987 (1997-2000)

*Southwestern Bell's Learning Communities Initiative.* Developed for Tech Prep of the Rio Grande Valley, Inc. (Harlingen, Texas); the Center for Professional Teacher Development, University of Texas – Brownsville; Teach for America – Rio Grande Valley (McAllen, Texas); and Education Service Center, Region One (Edinburg, Texas). Research team: Patricia G. Bubb, Executive Director (PI), Tech Prep of the Rio Grande Valley; Martin Winchester, Executive Director, Teach for America – Rio Grande Valley; Aileen Johnson, Director, School of Education, University of Texas – Brownsville; and Sylvia D. Hall-Ellis. Southwestern Bell Foundation, \$100,000 (1997-1998)

*Texas School to Work: Regional Implementation.* Developed for Tech Prep of the Rio Grande Valley, Inc. (Harlingen), South Texas Community College (McAllen), Texas State Technical College (Harlingen), Texas Southmost College (Brownsville), Empowerment Zone of the Rio Grande Valley (Mercedes), Project VIDA (Weslaco), Youth Fair Chance (McAllen), and Education Service Center, Region One (Edinburg). Research team: Patricia G. Bubb (PI), Tech Prep of the Rio Grande Valley; Stephen Vassberg, Texas State Technical College; Ellen Trevino, Youth Fair Chance; Wanda Garza, Project VIDA; Leonardo Olivares, University of Texas – Pan American; Michael Bell, South Texas Community College; and Sylvia D. Hall-Ellis. Texas Workforce Commission, \$4,250,000 (1997-2002).



*Comprehensive Bilingual Education Grant for Hidalgo ISD and Roma ISD.* Developed for Hidalgo (Texas) ISD, Roma (Texas) ISD, College of Education, University of Texas – Pan American (Edinburg, Texas), and Education Service Center, Region One (Edinburg, Texas). Research team: Tomas Thomas (PI), Director, Office of Bilingual Education and Sylvia D. Hall-Ellis. U.S. Department of Education, Office of Bilingual Education and Minority Languages Affairs, \$1,531,361 (1997-2002)

Lopez High School, Porter High School, Rivera High School, Central Middle School, and Perkins Middle School, Brownsville (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$1,473,611 (1997-1998)

Donna High School, Todd Middle School, and Solis Middle School, Donna (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$704,052 (1997-1998)

Memorial Middle School and Nellie Schunior Middle School, La Joya Independent School District (Texas). Telecommunications Infrastructure Fund Board, \$293,641 (1997-1998)

Martin High School, Christen Middle School, Cigarroa Middle School, Lamar Middle School, Laredo (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$1,200,000 (1997-1998).

Lasara Middle School, Lasara (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$246,210 (1997-1998)

Los Fresnos High School and Resaca Middle School, Los Fresnos (Texas) Consolidated Independent School District. Telecommunications Infrastructure Fund Board, \$500,000 (1997-1998)

Lyford Junior High School, Lyford (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$354,997 (1997-1998)

Travis Middle School, McAllen (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$269,139 (1997-1998)

Mission High School, Mission (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$297,010 (1997-1998)

Progreso High School, Progreso (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$300,000 (1997-1998)

San Perlita High School, San Perlita (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$293,490 (1997-1998)

Myra Green Junior High School, Raymondville (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$225,000 (1997-1998)

Rio Grande City High School, Ringgold Middle School, Gruella Middle School, Rio Grande City (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$809,934 (1997-1998)

Rio Hondo Junior High School, Rio Hondo (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$297,024 (1997-1998)

Roma High School, Roma (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$333,178 (1997-1998)

San Benito High School, Miller Jordan Junior High School, San Benito (Texas) Consolidated Independent School District. Telecommunications Infrastructure Fund Board, \$547,000 (1997-1998)

Santa Maria High School and Santa Maria Middle School, Santa Maria (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$400,000 (1997-1998)

Salvador High School, United Independent School District (Laredo, Texas). Telecommunications Infrastructure Fund Board, \$250,879 (1997-1998)

Weslaco High School, Cabaza Middle School, Cuellar Middle School, Weslaco (Texas) Independent School District. Telecommunications Infrastructure Fund Board, \$874,242 (1997-1998)

*Principals' Assessment and Training Center.* Developed for Education Service Center, Region One (Edinburg, Texas). Research team: Roberto Zamora, Leonel Barrera, William H. Parry, and Sylvia D. Hall-Ellis. Texas Principals' Leadership Initiative, Texas Association of Secondary School Principals, Texas Association of Elementary School Principals, and the Sid Richardson Foundation. \$461,439 (1996-1998)

*The Texas Library Connection -- Integrating and Sharing Resources.* Developed for Hidalgo County Library System (McAllen), Cameron County Library System (Brownsville), South Texas Community College (McAllen), the University of Texas - Pan American (Edinburg), University of Texas - Brownsville, and Education Service Center, Region One (Edinburg). Research team: William R. McGee, Coordinator, Hidalgo County Library System; Joe Garcia, Director, Cameron County Library System; Michael D. Bell, Library Director, South Texas Community College; Eleanor Folger Foster, University Library, University of Texas - Pan American; Jaime Vela (PI), Director of Instructional Technology and Media Services, Ron Pontius, Instructional Technology, and Fabiola Fuentes, Media Services, Education Service Center, Region One; and Sylvia D. Hall-Ellis. Office of Library Media Services, Technology Services, Texas Education Agency. \$8,000 (1996-1997)

*Developing Leadership Communities for Improving Algebra I for All Students.* Developed for a partnership of the Region One Statewide Systemic Initiative Team. Research team: Noel Villarreal (PI), Eduardo Cancino, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Statewide Systemic Initiative for Reform in Mathematics, Science and Technology Education to The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin. \$25,000 (1996-1997)

*Academics 2000: First Things First -- The Texas Goals 2000.* Developed for Edinburg (Texas) CISD. Research team: Hilda Medrano, Dean, College of Education, University of Texas - Pan American (Edinburg); Helen Jones, Director (PI), Gifted and Talented Education, Edinburg CISD; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$750,000 (1996-2001)

*Texas Teachers Empowered for Achievement in Mathematics (TEXTEAM) Institute for Algebra I.* Developed for Hidalgo ISD, Jim Hogg (Hebbronville) County ISD, La Joya ISD, La Villa ISD, Lyford ISD, Mission CISD, Pharr-San Juan-Alamo ISD, Rio Hondo ISD, San Isidro ISD, San Perlita ISD, Santa Maria ISD, Santa Rosa, Sharyland ISD, Valley View ISD, Webb (Laredo) CISD, Weslaco ISD, and Zapata County (Zapata) ISD. Research team: Noel Villarreal (PI), Chuck McInteer, Ellen M. Gonzalez, Education Service Center, Region One (Edinburg); and Sylvia D. Hall-Ellis. Charles A. Dana Center for Mathematics and Science Education, University of Texas - Austin, \$15,975 (1996)

*Community Learning Center for La Villa, Texas.* Developed for Edcouch-Elsa Independent School District. Research team: Noe Gonzalez (PI), Assistant Superintendent, Edcouch-Elsa Independent School District, and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$325,000 (1996-1997)

*Monte Alto (Texas) Community Learning Center.* Developed for Monte Alto Independent School District. Research team: Homero A. Diaz (PI), Superintendent, Monte Alto Independent School District, and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$300,000 (1996-1997)

*Community Learning Center for La Villa, Texas.* Developed for La Villa Independent School District. Research team: Sam Gonzalez (PI), Assistant Superintendent, La Villa Independent School District; and Sylvia D. Hall-Ellis. Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$325,000 (1996-1997)

*Building Project for Taylor Elementary.* Developed for Mercedes (Texas) Independent School District. Research team: Mrs. Denise Rivera, Librarian, and Eduardo Infante, Principal, Taylor Elementary School; Ismael S. Cantu (PI), Federal Programs Director, Mercedes Independent School District; and Sylvia D. Hall-Ellis, Delta Region Subzone, Rio Grande Valley (Texas) Rural Empowerment Zone, \$375,000 (1996-1997)

*Border Education Network (BEN) - Distance Education through Cable Television.* Developed for Edinburg (Texas) Consolidated Independent School District. Research team: Noe Torres (PI), Library Media Specialist, Magdalena Rosas, Library Media and Technology Coordinator, Edinburg Consolidated Independent School District; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Edinburg (Texas) Consolidated School District, \$250,000 (1996-1997)

*Multiservice One-Stop Open Enrollment Charter School.* Developed for the Information Referral Resource Assistance, Inc. (McAllen, Texas). Research team: Pablo Perez and Aggie Pena (PI), Executive Director, Information Referral Resource Assistance, Inc.; Roberto Zamora and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$3,066,000 (1996-2001)

*Project OK: A Community Youth Opportunities Grant for Summer, 1996.* Developed for McAllen (Texas) Independent School District, St. Joseph the Worker Catholic Church, and the Office of Adult Education, Education Service Center, Region One. Research team: Father Bart Flatt, St. Joseph the Worker Catholic Church; Noe Calvillo (PI), Office of Adult Education; Maria Louisa Garcia, McAllen Independent School District; and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Protective and Regulatory Agency through the Office of the Mayor, City of McAllen, \$350,000 (1996-2001).

*Early Childhood: a Time of Discovery.* Developed for a partnership of Lasara ISD, Rio Hondo ISD, San Perlita ISD, the School of Education, University of Texas - Brownsville, and Education Service Center, Region One (Edinburg). Research team: Hugo Rodriguez, Dean, School of Education, University of Texas - Pan American; Leonel Barrera and Jack Damron, Field Service Agents, Ellen M. Gonzalez (PI), Administrator for Student Instructional Services, Ruth Solis, Education Specialist in Special Education, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$722,090 (1996-2001)

*Innovative Gifted and Talented Programs for Early Childhood and Elementary Education Students.* Developed for a partnership of Edinburg (Texas) CISD, the School of Education, University of Texas - Pan American (Edinburg), and Education Service Center, Region One (Edinburg). Research team: Hilda Medrano, Dean, School of Education, University of Texas - Pan American; Helen de la Garza (PI), Director of Elementary Curriculum and Instruction, Edinburg CISD; and Sylvia D. Hall-Ellis. Texas Education Agency, \$750,000 (1996-2001)

*Reading Recovery in Early Elementary Grades.* Developed for a partnership of La Villa (Texas) ISD the School of Education, University of Texas - Pan American (Edinburg), and Education Service Center, Region One (Edinburg). Research team: Hilda Medrano, Dean, School of Education, University of Texas - Pan American; Marcario Salinas (PI), Supervisor of Elementary Curriculum and Instruction, La Villa ISD; and Sylvia D. Hall-Ellis, Education Service Center, Region One. Texas Education Agency, \$750,000 (1996-2001)

*Connected Mathematics Project for Middle and Junior High Students.* Developed for a partnership of Michigan State University, The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin and Region One Statewide Systemic Initiative Team. Research team: Jack Damron, Chuck McInter, Noel Villarreal (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). National Science Foundation through Michigan State University to the Charles A. Dana Center at the University of Texas - Austin, \$539,610 (1996-1999)

*Sharing Resources: Testing the Interlibrary Loan Potential of the Texas Library Connection -- Integrating Media Resources.* Developed under the sponsorship of the Hidalgo County Library System (McAllen) and Education Service Center, Region One (Edinburg). Research team: William H. McGee, Hidalgo County System Coordinator; Fabiola Fuentes, Library Media; Ronald Pontius (PI), Instructional Technology, Education Service Center, Region One; and Sylvia D. Hall-Ellis. Library Media Services Program, Office of Technology Services, Texas Education Agency, \$25,000 (1996-1997)

*State and Federal Adult Education JOBS Program.* Developed for Education Service Center, Region One (Edinburg). Research team: Noe Calvillo (PI), Director, Adult Education Program, and Sylvia D. Hall-Ellis. Adult Education Program, Texas Education Agency, \$532,846 (1995-1996)

*Creating Safe and Drug-Free Schools and Communities.* Developed for a partnership of the Region One Consortium for Safe and Drug-Free Education Environments. Research team: Clara Contreras (PI), Health Specialist, and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Education Agency, \$150,000 (1995-1996)

*Developing Leadership Communities for Improving Mathematics Performance for All Students on Title I Campuses.* Developed for a partnership of the Region One Statewide Systemic Initiative Team. Research team: Jack Damron, Chuck McInteer, Noel Villarreal (PI), and Sylvia D. Hall-Ellis, Education Service Center, Region One (Edinburg). Texas Statewide Systemic Initiative for Reform in Mathematics, Science and Technology Education to The Charles A. Dana Center for Mathematics and Science Education, The University of Texas at Austin, \$50,669 (1995-1996)

*The Impact of Library Resource Centers on Academic Achievement in Selected Public Schools in South Texas.* Sylvia D. Hall-Ellis (PI). Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville). Texas Association of School Librarians, Children's Services Round Table, and Young Adults Round Table (Austin, Texas), \$2,500 (1995)

*School Library Media Specialists Fellowship Program.* Sylvia D. Hall-Ellis (PI). Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville, Texas). U.S. Department of Education, HEA Title II-B, Library Education and Human Resource Development Program, \$44,000 (1995-1996)

*Planning for Educational Technology.* Research team: Ruth Ann Riggins (PI), Director of Library Media and Technology Services, Donna (Texas) Independent School District; Noe Torres, Education Service Center, Region One; Patricia G. Bubb, Tech Prep of the Rio Grande Calley, Inc; Michael D. Bell, South Texas Community College; and Sylvia D. Hall-Ellis, Sam Houston State University. Developed under the sponsorship of Donna (Texas) Independent School District, Education Service Center, Region One (Edinburg), Tech Prep of the Rio Grande Valley, Inc. (Harlingen), South Texas Community College (McAllen), and the Department of Library Science, Sam Houston State University (Huntsville). Funded through Infusion of Educational Technology Planning Grant Program (H.B. 18: Models). Texas Education Agency, \$18,000 (1993-1994)

*The Impact of Library Resource Centers on Academic Achievement in Selected Public Schools in South Texas.* Sylvia D. Hall-Ellis (PI) and Mary Ann Berry. Developed under the sponsorship of the Department of Library Science, College of Education and Applied Science, Sam Houston State University (Huntsville). Sam Houston State University Research Enhancement Fund, \$7,500 (1993-1994)

*Electronic Mail Resource Sharing System: Management and Operation of the Iowa Computer-Assisted Network.* State Library of Iowa, \$294,000 (1986-1993)

*The Iowa Locator: A CD-ROM Resource Sharing Tool.* State Library of Iowa, \$567,000 (1986-1992)

*Statewide Database Development: An OCLC Tape Analysis To Determine Feasibility.* State Library of South Dakota, \$15,000 (1987)

*The Iowa Locator: A Feasibility Study.* State Library of Iowa, \$50,000 (1986)

*Electronic Mail Resource Sharing System: A Feasibility Study for Libraries in the State of Iowa.* State Library of Iowa, \$5,000 (1985)

*Access Pennsylvania: A Feasibility Study.* State Library of Pennsylvania, \$50,000 (1984)

*Automating Library Administrative and Management Tasks: Procurement and Distribution of Microcomputer Systems for District Library Centers in the Commonwealth of Pennsylvania.* State Library of Pennsylvania, \$495,000 (1982)

*Sharing Serial Titles Resources: Procurement and Distribution of Microfiche Readers for 550 Libraries in the Commonwealth of Pennsylvania.* State Library of Pennsylvania, \$500,000 (1982)

*Electronic Mail System: A Pilot Project for Libraries throughout the Commonwealth of Pennsylvania.* State Library of Pennsylvania, \$125,000 (1982)

*Literacy Program for Adults in Rural Upstate New York State: Program Outreach and Evaluation - Phase 3.* Appalachian Regional Commission, \$50,000 (1981)

*Database Building: A Cooperative Project of the Finger Lakes Library System (Ithaca), Four County Library System (Binghamton), and the Southern Tier Library System (Corning).* New York State Library, \$450,000 (1980-1985)

*Faces of the Southern Tier: A Professional Photographer-in-Residence.* New York State National Endowment for the Humanities, \$25,000 (1980)

*Literacy Program for Adults in Rural Upstate New York State: Program Implementation - Phase 2.* Appalachian Regional Commission, \$50,000 (1980)

*Small Business Resources Center: A Pilot Project for Rural Public Libraries.* New York State Library, \$50,000 (1980)

*Media Programming: A Professional Development Program for Public Librarians in Upstate New York: A Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties.* New York State Library, \$35,000 (1979)

*Information and Library Resources for Inmates and Prisoners in Selected Upstate New York Facilities: A Cooperative Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties.* New York State Library, \$25,000 (1979)

*Library Resources for Homebound Adults in Upstate New York: An Outreach Program in Allegheny, Chemung, Schuyler, Steuben, and Yates Counties.* New York State Library, \$40,000 (1979)

*Literacy Program for Adults in Rural Upstate New York State: Program Initiation and Establishment - Phase 1.* Funded by the Appalachian Regional Commission. Awarded to the Corning (New York) Public Library, \$50,000 (1979)

*Information Reference Services to Homebound Adults.* New York State Library, \$31,000 (1978)

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### **Project Strategic Planning & Funding Proposal Development**

Walden University, 2015.

Pikes Peak Library District, 2014.

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Denver School for Science and Technology, 2008-2011.

Johnson & Wales University, Denver Campus, 2007-2009.

Challenges, Choices, and Images K-12 Charter School, Denver Public Schools, 2007.

Denver Medical Library, Inc., 2006-2010.

Bemis Public Library (Littleton), Ergonomic Design and Facilities Enhancement Consultant, 2003.

Curtis Park Community Center (Denver), Community Technology Center Evaluation and Proposal Development Consultant, 2003.

Colorado Community Based Research Network (Denver), Funding Research Associate, 2002-

Our Lady of the Rosary Academy (Edgewater), Learning Resource Center Development Project Consultant, 2001-

University of Southern Colorado (Pueblo). Technology Integration and Curriculum Enhancement into Higher Education Learning Environment. Proposal Development Consultant, 2000.

Jefferson County Library System (Lakewood), 1999-2000.

Southeastern BOCES (Lamar, CO). Distance Learning Curriculum Content Development Project. Proposal Development Consultant, 1998-2004.

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Telecommunications Infrastructure Fund Board Round #1, 1996. Technical assistance to the following: Brownsville (Texas) Independent School District; Donna (Texas) Independent School District; Edinburg (Texas) Consolidated Independent School District; Harlingen (Texas) Consolidated Independent School District; Jim Hogg County Independent School District (Hebbronville, Texas); La Feria (Texas) Independent School District; La Joya (Texas) Independent School District; La Villa (Texas) Independent School District; Los Fresnos (Texas) Consolidated Independent School District; Progreso (Texas) Independent School District; Raymondville (Texas) Independent School District; Rio Hondo (Texas) Independent School District; San Benito (Texas) Independent School District; Sharyland Independent School District (Mission, Texas); Weslaco (Texas) Independent School District; Zapata (Texas) County Independent School District.

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Southern Tier Library System (Corning, NY). OCLC Acquisitions Subsystem Evaluation, 1981. Principal Investigator.

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### **Cataloging & Bibliographic Database Building**

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Retrospective Conversion Projects: North Central Regional Library Service (Mason City, IA), 1987-1988; Southeastern Library Services (Davenport, IA), 1986-1987; Virginia Theological Seminary (Alexandria), 1984-1985; California University of Pennsylvania (California, PA), 1984-1985; Kennametal Corporation (Latrobe, PA), 1984-1985; West Virginia University (Morgantown), 1983-1985; Altoona Area Public Library (Altoona, PA), 1983-1984; George Washington University (Washington, DC), 1983-1984; Indiana University of Pennsylvania (Indiana, PA), 1983-1985; Health Education Center (Pittsburgh), 1983-1984; Central Pennsylvania District Library Center (Bellefonte, PA), 1982-1985; Duquesne University Law School Library (Pittsburgh), 1982-1983; Allegheny County Law Library (Pittsburgh), 1982-1984; Calgon Technical Information Center (Pittsburgh), 1982; Dow Corning Corporation, Technical Information Center (Midland, MI), 1982-1983; Tri-System Public Library Retrospective Conversion Project (Binghamton, Corning, and Ithaca, NY), 1978-1981, Technical Project Director.

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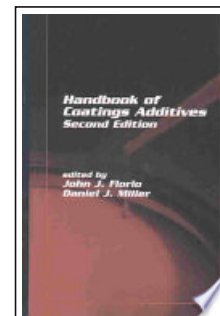
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JJ Florio, DJ Miller - 2004 - [content.taylorfrancis.com](https://content.taylorfrancis.com)

A coating additive. is a substance that is added to a paint formula to improve a particular characteristic of the paint. The additive usually constitutes a small percentage of the paint and can improve properties of the wet paint, ie, rheology and pigment wetting, or it can ...

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## Additives for plastics handbook

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## Handbook of cereal science and technology

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ASH Makhoulf, H Soliman - **Handbook of Nanoceramic and Nanocomposite** ..., 2015 - Elsevier

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# 8

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## Biocides: Wet State and Dry Film

**Paul S. Kappock**

Arch Chemicals, Inc., Cheshire, Connecticut, U.S.A.

### 8.1 INTRODUCTION

#### 8.1.1 Historical Perspective

Microbes have been defacing paints films ever since the first binders and pigments were mixed and applied as crude protective coatings. Up until and into the 20th century, solvent-borne coatings utilizing seed oils for binders were used almost exclusively. The most common seed oil used was linseed. All that is needed for the growth of fungus on paint films is sufficient moisture. This is supplied by precipitation and condensation. The paint surface provides the necessary nutrients. These nutrients are provided by the organic materials that compose the paint film and/or are provided by airborne organic debris. Natural oil binders are low-molecular-weight materials that are easily metabolized by fungi. With the development of alkyds, higher-molecular-weight binders resulted in paint films with more resistance to the growth of fungi, although the long oil alkyds that are used for architectural exterior paints are still quite susceptible. Generally, materials with molecular weights of less than 600 are readily metabolized. Higher-molecular-weight organic materials are broken down by enzymes and acids released by the micro-organisms to smaller units that can then be metabolized by the organism.

These early coatings received some protection against the growth of fungus from metallic pigments that contained zinc, mercury (cinnabar,

vermilion), or chromium (green cinnabar). Later, organometallic materials such as phenyl mercuric oleate (PMO), phenyl mercuric acetate (PMA) and TBTO (bis-tributyltin oxide) were used with greater success, especially with the mercurials. However, the mercury compounds were eventually forbidden for use in paints by the U.S. EPA (Environmental Protection Agency) because of toxicity, ecotoxicity, and environmental persistence. TBTO is no longer being used in antifoulant paints because of ecotoxicity and environmental persistence, but it is still used in some wood preservative preparations and coatings. Today, there are a number of effective products on the market for preserving dry paint films. These will be discussed in a later section.

High-quality waterborne coatings did not become available until the development of styrene butadiene emulsions during the 1940s. With the growing volume of waterborne coatings came a greater demand for preservation of the paint in the wet state. The abundant water available in the wet state, along with the low-molecular-weight organic additives, presents an ideal environment for the growth of bacteria. Fungi (molds and yeasts) can also grow in paints in the wet state, but it is mostly the bacteria of the genus *Pseudomonas* and *Enterobacter* that cause the most damage. Bacteria grow much faster than fungi under ideal conditions, doubling in population as quickly as every 20 min.

Phenyl mercuric acetate was widely used for wet state preservation in the United States until banned by the EPA for use in paints. PMA would function as both a wet-state and dry-film preservative. Formaldehyde-releasing compounds replaced PMA for the most part and are still widely used in paints. Because formaldehyde is recognized as a carcinogen and a VOC (volatile organic compound), there has been a move away from formaldehyde-releasing bactericides and toward isothiazalones. The isothiazalones have their own problems, such as being sensitizers, poor stability in paints, and most isothiazalones are sensitive to amines and sulfides. Among the simplest formaldehyde-releasing compounds are the condensates of amines and formaldehyde. One of the first to be synthesized was the condensate of ammonia and formaldehyde in the 1800s to yield hexamethylene tetramine (HTA). HTA and similar amine formaldehyde condensates will go back to the starting materials ammonia and formaldehyde under acidic conditions. In practice, acidic conditions are encountered in alkaline paints in the localized environment of bacteria that will release acidic metabolites. The released formaldehyde kills the bacteria. The pH dependency of formaldehyde release can be eliminated by quaternizing HTA [1]. Formaldehyde release then becomes pH independent.

These early bactericides were originally developed to be used by the medical profession as disinfectants. However, some like 1-(3-chloroallyl)-2,5,7-triaza-1-azoniaadamantane chloride are widely used in preserving aqueous coatings today. The effectiveness of formaldehyde-releasing bactericides can generally be determined by the amount of formaldehyde that can be measured by the Tannenbaum method [2]. This method uses the reaction of dilute aqueous bactericide solutions with phenylhydrazine and potassium hexacyanoferrate.

### 8.1.2 Consequences of Biodeterioration

Microbes were the first forms of life on Earth. Their presence goes back about three and a half billion years. It is safe to say they will be around for many more years. Microbes exist practically everywhere and their destructive activity is basically unavoidable, but can be inhibited. Using microbicides can be viewed as protecting the environment. Allowing materials to last longer prevents them from being disposed of and also uses less electrical power and raw materials to replace the degraded objects. If uncontrolled, microbes will contaminate coatings in the dry and wet states, leading to degradation of the wet paint and destruction of the paint film. Not having to dispose of spoiled paints and not having to repaint objects as often contributes to protection of the environment.

Understanding some of the basic biocide terminology is important for understanding the discussions that will follow in this chapter.

- Biocide: any compound that is capable of killing living organisms.
- Microbicide: any compound capable of killing microbes.
- Bactericide: any compound that kills bacteria.
- Fungicide: any compound that kills fungi.
- Algicide: any compound that kills algae.
- Microbistat: any compound that inhibits the growth of microorganisms without necessarily killing the organism.
- Microbicides at very low concentrations could also function as microbistats.

There are many microbicides that are available for many different industries, but only a limited number are suitable for use in coatings. Microbicides that are used commercially are targeted to the organisms that cause the damage with minimal impact on higher organisms. The microbes of interest to the coatings industry are bacteria, fungi (mold, mildew), yeasts (unicellular fungi), and algae.

Bacteria are the principle degraders of paint in the wet state. Fungi and yeasts also are capable, but are usually much less of a problem. Many of the organic materials in paints can serve as nutrients. Some of the indications of contaminated paint include foul odor, drop in pH and viscosity, generation of gas, color changes, can corrosion, lumping and stringiness of the latex, and gelation of the paint. Bacteria can even degrade and detoxify the dry-film preservative added to the paint to protect against the growth of mildew on the paint film. The production of enzymes by the organisms makes it almost impossible to recover spoiled paint. Even if a bactericide is added and kills all the bacteria in the paint, the enzymes still remain and can break down materials in the paint. Springle studied the effects of the enzyme cellulase on the cellulosic thickeners common in aqueous paints [3]. Concentrations as low as 0.00001 mol/mm can lead to degradation of the thickener.

The cost of damaged paints can be quite high when all the incidentals are taken in to account. In addition to the cost of the paint itself, there is the cost of returning the spoiled paint to the manufacturer, the cost of disposal, lost profit, loss of future sales because of diminished reputation, and the legal costs of claims of illnesses caused by individuals exposed to the spoiled paint. The costs to the manufacturer of spoiled paint could be substantial, running as high as \$200.00 per gallon or more, when all these consequences are considered.

Preservation of the dry paint film against microbial growth is also necessary for most exterior and some interior applications. In the home, bathrooms, kitchens, and basements are often damp enough to support the growth of mildew on paint films. In industry, dairies, breweries, bakeries, and food processing need to have mold-resistant walls for hygienic reasons. These even coatings on the market for hospitals that claim to resist the growth of mildew and bacteria on the dry film.

Hygienic issues aside, most dry-film preservative use is in outdoor applications for esthetic reasons and extending the useful life of the coating. Mildew and algae grow on paint films when sufficient moisture is present. Nutrients are supplied by organic materials in the paint film and also by airborne organic debris that has settled on the film. Some types of fungus, such as *Aureobasidium pullulans*, can grow under fairly harsh conditions, but algae generally require more moisture than fungi. Both will contribute to degradation of the paint film. The fungi produce acidic metabolites and enzymes that actively degrade the paint film. Algae cause problems indirectly by keeping the paint film moist. Loss of adhesion, decay, or corrosion of the substrate, allergic responses, and release of toxic gasses (mycotoxins) have been attributed to fungal growth on and in buildings.

### 8.1.3 Current Trends

#### 8.1.3.1 Government Regulations

Much of the drive behind current trends affecting the biocidal products that are available is government regulations. There are several major initiatives that will be slowly adopted over the next decade. In the United States, the regulation of biocides for the coatings industry falls under the jurisdiction of the EPA. Congress gave the EPA responsibility under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). All bactericides, fungicides, and algacides used in coatings are classified under FIFRA as pesticides. In 1988, the congress passed an amendment to FIFRA that subjected all pesticides registered before 1984 to data recall. Congress realized that the data used to assess the effects of pesticide exposure to humans and the environment had become outdated in some cases. Newer methods of detection and assessment were developed that would shed a clearer light on the hazards of using pesticides. The EPA grouped all registered pesticides into 600 cases. These 600 cases comprised ~1150 active compounds and 45,000 formulated products. With so many products to review, along with many other EPA responsibilities, it is likely that the process will take a very long time. The first data recall procedure did not occur until 2001 and is not expected to be completed for several years.

The type of data required for supporting registration varies by product and intended use patterns, toxicity, availability to the environment, rate of degradation in the environment, and composition of degradants. The inevitable consequence of the data recall would be higher costs and less products to choose from.

In Europe, the unification of the economies to form the European Union has led to the Biocides Product Directive (BPD). It was realized that regulation of pesticides could be a trade barrier and that to avoid the barrier, a unified set of regulations was needed. The whole process is expected to take over a decade to be fully implemented. In Europe, blends of biocides are commonly used in coatings. The practice is not common in the United States due to the need to have each blend registered with the EPA. In Europe, only the actives needed to be registered and could be used in blends without the blends themselves needing registration. That will change with the BPD. With the high cost of registration and uncertain future, some of the European blenders chose to be acquired by biocide producers in the United States. A few of the common European blends for coatings have been registered in the United States and are available commercially. Development of new blends for the US market is the focus of product development by suppliers looking



for new opportunities. A few have been registered and more are likely to become available.

Another major regulatory initiative is the international ban of tin compounds in antifoulant paints. The International Maritime Organization (IMO) passed the resolution and was approved by a diplomatic conference in 2001. When countries that account for 25% of the world's ship tonnage ratify the treaty, it will become international law. The treaty provides for banning the application of tin-containing paints by 2003 and banning the presence of tin-containing paints on ships hulls by 2008. Tin compounds such as tributyl tin oxide (TBTO) and tin copolymers are used in antifoulant paints to control the growth of algae. Tin compounds are not very effective against hard fouling such as barnacles. Copper, as cuprous oxide, is used to control hard fouling. The compounds that are replacing tin in antifoulant paints are also effective in controlling the growth of algae in architectural paints.

Most dry-film preservatives on the market in the United States are not effective against algae, only fungi. A few of the replacements for tin in antifoulant paints, zinc pyrithione and 4,5-dichloro-2-*n*-octyl-4-isothiazalin, are effective against both fungi and algae in architectural paints. Thus, the manufacturers of architectural paints have benefited from the tin ban by having more dry-film preservatives to choose from that likely would not have been available if tin were still allowed to be used in antifoulant paints. The suppliers of these compounds would not have gone through the expense of U.S. EPA registration unless there was a large market and opportunity that the tin ban provided.

### 8.1.3.2 Indoor Air Quality

It has long been known that people have allergic reactions to fungal spores. More recently, organisms have been implicated in causing more severe damage to humans such as central nervous system damage and death. The outbreak of *Legionella pneumophila* in 1976 was the beginning of media attention to building related illnesses and sick building syndrome (SBS). The World Health Organization has defined sick building syndrome as a situation where 20% of a building's occupants complain of physical problems that occur soon after entering the building, the problem gets worse while they are in the building, and the problem ceases after they leave the building [4]. Obviously, discomfort caused by temperature and noise would not be caused by micro-organisms, but allergens and toxins produced by fungi could cause discomfort or worse. Thus, the definition is vague and the contribution of micro-organisms not well documented, with the exception of well-known infectious contaminants. When the indoor



humidity is above 60% for extended periods of time, microbial growth can occur on materials in the building that hold the moisture and provide a nutrient source [5]. Although it is unlikely that the painted surfaces in most buildings would be a significant source for microbial growth that would lead to illness, there are interior paints available that provide protection of the dry film against the growth of bacteria and fungi. The increase in availability of these paints is invariably the result of heightened awareness to the problem of indoor air quality brought about by media attention. As mentioned earlier, some buildings such as breweries and food processing plants need to have fungicides in the paint films because the high moisture levels and nutrients that settle on the paint film provide an excellent environment for fungal growth.

It is the airborne spores and the mycotoxins produced by the fungi that cause the problems with indoor air quality. There are about 20 common genres of airborne fungi, with *Cladasporium*, *Alternaria*, *Penicillium*, *Aspergillus*, *Fusarium*, and *Aureobasidium* being the most common [6]. All are capable of causing allergic reactions in susceptible people [7]. *Alternaria*, *Aspergillus*, and *Penicillium* have been identified as mycotoxin producers [8]. However, it is *Stachybotrys chartarum* that is the fungus receiving a lot of attention in the media. Recently, its occurrence and implication in building-related illnesses is being intensely investigated and reported on. Under the right conditions, *Stachybotrys* can produce mycotoxins that are inhibitors of DNA, RNA, and protein synthesis [9]. Studies of the effects of exposure to *Stachybotrys* in water-damaged buildings have not conclusively proved that the organism caused health hazards. However, the studies have brought more attention to the presence of this and other organisms that have not been extensively acknowledged previously as toxigenic fungi [10-13].

## 8.2 TECHNICAL CONSIDERATIONS

### 8.2.1 Basic Causes for the Spoilage of Paint in the Wet State

Because waterborne coatings consist of water and organic materials, bacteria and, to a lesser extent, fungi can thrive and multiply quickly to spoil the paint. Also, because contamination of the paint by these organisms is practically unavoidable, a wet-state preservative must be used if the paint will not be used within a few days.

Contamination can arise from raw materials such as extender pigments and slurries. The water supply itself will have a significant amount of bacteria present unless run through a sterilization procedure.

Contamination from equipment is a major source of bacteria being introduced to paint. Tanks and lines that are rinsed out after a batch of paint is made can become breeding grounds for bacteria, especially in dead areas where water collects. Splash areas on mixing shafts and tank lids also provide ideal surfaces for micro-organisms to proliferate. Condensation and drippings from these areas into the paint are common sources of contamination. Recycled wash water must be treated to prevent bacteria from growing and contaminating fresh paint. Dust particles will also carry micro-organisms that can end up in the paint. Sometimes, when a batch of paint is being held up waiting for the quality control (QC) department to make adjustments, a layer of water is added to the surface to prevent skinning. Sometimes, this layer is left overnight. A bactericide must be added to this layer to prevent bacteria from growing because the bactericide added to the paint will not defuse into the water layer in sufficient quantity to have much of an effect.

Plant hygiene is an essential part of the process for preventing paints from spoiling. Because equipment configurations vary greatly, individual customized plant audits should be performed periodically by the biocide supplier.

### **8.2.2 Conditions That Affect the Growth of Micro-organisms on Paint Films**

The type and extent of microbial growth on paint films is influenced by many factors. This makes predicting and preventing growth at a reasonable cost difficult. An understanding of the conditions that influence growth can help in formulating paints resistant to the growth of micro-organisms. Some of these variables are climate, air quality, building design, substrate, landscaping, and paint formulation. Mildew (fungus) and algae have both similar and different requirements for growth. Both require moisture, oxygen, carbon, and nitrogen nutrients, trace minerals, and temperatures between 15°C and 35°C for optimal growth. Algae require light for photosynthesis, whereas mildew does not. Mildew must obtain the necessary nutrients from the substrate; algae can fix carbon from the carbon dioxide in the air. Many species of algae can also fix nitrogen from the air. The ideal pH range for mildew is neutral to acidic; algae grow better on neutral to alkaline substrates. Often the conditions for the growth of both mildew and algae are present together and both can be seen growing on a building. For the species of algae and fungi that grow on painted surfaces, algae generally require more moisture than fungi. On very wet surfaces, algae usually will grow alone. On drier surfaces, usually only fungi grow [14].

The climate has a great influence on the type and degree of microbial growth on buildings. Higher temperatures generally favor greater microbial growth. High humidity and/or considerable rainfall will accelerate growth. Temperature extremes such as warm humid days and cool nights can lead to condensation on walls. Heavy rainfall will extract materials from a paint film and also the substrate if the film is porous enough. These materials can be nutrients or toxins and will be discussed in more detail. The season the paint is applied can also effect how quickly and severely the film is infested with growth. A paint film is most susceptible to growth soon after it is applied because the low-molecular-weight organic materials (thickeners, dispersants, etc.) are readily available as nutrients to mildew. If the application of the paint coincides with a wet season, rapid growth of micro-organisms may occur if the paint is not sufficiently protected with an algacide/fungicide. Prevailing winds can also effect the growth of micro-organisms. Soil (farming or excavation activity), vegetation, and bodies of water are all sources of spores and propagules. If a building is downwind from these sources, chances for deposition and growth on the building is increased. North and Davis reported recovering a greater diversity of micro-organisms in the air during the spring and summer months in Florida and speculated that this was due to increased farming activity [15]. Cultivated soils typically produce higher concentrations and greater diversity of spores than noncultivated soils [16].

Desiccated soil, easily blown about by the wind, can carry spores of fungi and algae and also nutrients to the surface of a paint film. Pollution can also deposit carbon and nitrogen onto a paint film, providing nutrients to fungi. Pollen and detritus from dead vegetation can settle on a painted surface and provide nutrients to micro-organisms. Another source of airborne nutrients that find their way onto painted surfaces are bird and insect droppings.

Building design can have a profound effect on the amount of water to which a painted surface is subjected. Runoff from roofs, sills, and balconies onto painted surfaces is sure to lead to the growth of algae or mildew no matter how much biocide is added to the paint. If the building does not have a properly designed vapor barrier, moisture transmission from outside to inside can occur if the building is air conditioned. This may lead to condensation of water on the inside wall, increasing the chance for mildew growth. If the building is heated, moisture vapor transmission will move from inside to outside and may lead to condensation on the outside wall. Air conditioned buildings could also have condensation on the outside walls if there is poor insulation and the outside air is warm and moist. This is a common observation on gloss white concrete residential roofs in Florida

that do not have good insulation. Overnight condensation can remain on the roof into the afternoon.

Roofs that do not overhang the walls and do not have gutters will allow excessive water to run down the walls and also splash up onto the walls after hitting the ground, carrying spores from the soil onto the walls. Insufficient or improper expansion and control joints on masonry buildings will lead to cracks in the surface. These cracks will collect nutrients, spores, and moisture and lead to the growth of micro-organisms.

The substrate is a very important consideration when deciding on the amount and type of biocide to add to a paint. Wood has a lower pH, usually 4–5, and is more favorable to the growth of fungi. Fungi generally grow faster than algae on surfaces where the pH is lower than 8 [17]. Wood is also a very good source of nutrients for fungi. These nutrients can migrate through a paint film, especially a film with a high PVC (pigment volume concentration). Very often, wood is already supporting the growth of fungi before it is painted and the fungi can grow through the film from the substrate. Wood retains moisture. Even kiln-dried lumber has a 15% moisture content. Wood is dimensionally unstable. It will expand and contract with changes in moisture and temperature. This could lead to cracking of the paint film and expose the wood to micro-organisms. Nutrients and moisture will also collect in the cracks.

Masonry is more resistant to the growth of mildew because it is alkaline. The pH is usually around 12 when it is new, dropping to near neutral after several years, depending on the amount of rainfall, if it is painted, and the type of paint. The alkaline salts can migrate through the paint film and inhibit the growth of mildew. Algae will tolerate a higher pH and often grow on masonry surfaces in the absence of fungi. The rough texture of masonry encourages the deposition of airborne dust, spores, and propagules.

The type and extent of landscaping around a building can influence the growth of micro-organisms. Trees and shrubbery near a building provide a moist microclimate, attract birds and insects, and are a source of organic debris and sap. Algae and fungi thrive on vegetation and can be blown by the wind from trees and shrubs onto a building. Wood chips and mulch are a good source of fungal spores. Debris from cutting grass and shrubs can blow onto a building and serve as a nutrient source. Any digging and disruption of the soil will release fungal and algal propagules into the air, increasing the chances of deposition onto a building nearby.

The paint formulation itself will have an impact on the resistance to growth of micro-organisms, both in the degree of primary infestation and secondary infestation. Primary infestation is growth that occurs on the paint film that is directly enhanced by materials that are in the paint film that

can serve as nutrient sources and are readily available to the organisms. Such materials found in emulsion paints are thickeners, particularly the cellulose, dispersants, defoamers, and wetting agents. In addition to being nutrients, some of these materials are also hydrophilic and will keep the film moist for a longer time after a rainfall. The more porous the paint film, the more readily these materials will leach out. The susceptibility of the paint film to primary infestation usually will last up to 6 months, depending on the rainfall, film porosity, and the type and quantity of leachable organic material. Inorganic leachable materials will facilitate algal growth. These materials include tripolyphosphates, such as KTPP and NaTPP, and carbonates, such as calcite and dolomite. Primary infestation is a complex interaction of paint formulation, substrate, climate, and local species of micro-organisms. The local community of micro-organisms include bacteria, fungi, and algae. The succession of these organisms on painted surfaces has had limited investigation. O'Neill concluded that initial infestation by bacteria degrades materials in the paint film, paving the way for fungal infestation [18].

Secondary infestation of paint film occurs when materials in the film break down such as the polymer and/or airborne nutrients are carried to the paint surface and are deposited. The binder may degrade by hydrolysis, photolysis, and oxidation. Acids and enzymes secreted by microbes also accelerate the degradation of the binder to lower-molecular-weight fragments that can be metabolized by the organisms. Acrylics are generally more resistant to degradation than the vinyl acrylics and usually support less growth of micro-organisms. Hard polymers are normally more resistant to collection of dirt and microbial propagules than soft polymers and, therefore, support less growth of micro-organisms.

Alkaline pigments such as calcium carbonate will inhibit the growth of fungi but may allow an increase in the growth of algae because there is no competition from the fungi and the calcium is a necessary nutrient for algae.

The PVC of the paint may also influence the degree of microbial growth on paint films [19]. Low-PVC paints will collect more dirt and spores if the binder is soft and thermoplastic. More growth of micro-organisms on low PVC paints is likely unless the binder is hard and hydrophobic. For masonry paints, choosing a hard styrene acrylic will improve the resistance of the coating to microbial growth. High-PVC paints also collect dirt and spores easily because the surface is rough and porous. Flat and matte finish paints should be formulated to the lowest possible PVC to minimize surface texture and porosity.

Because the thickness of a paint film has a direct effect on the resistance of the film to the growth of micro-organisms, the volume solids of the wet paint and the rheology are important considerations



when formulating for maximum resistance to growth. Dry-film preservatives must migrate out of the paint film to be effective. They must migrate slowly to have long-term protection. A thicker film will have a higher concentration of preservative per unit area and, therefore, will provide longer protection against microbial growth than a thin film of the same formulation.

The ideal dry-film preservative will have a broad spectrum of activity against algae and fungi, will migrate out of the paint film at a rate that provides a toxic concentration to the surface of the film, but will not migrate so fast that long-term efficacy will suffer. The paint formulation will also have a substantial influence on the rate of migration of a given dry-film preservative. The inherent solubility of the preservative in water and leachable components of the formulation together with the chemical and physical properties of the coating will determine how well and for how long the dry-film preservative will perform. Chemical and physical stability and uniform distribution of the dry-film preservative in the dry paint film are also desirable characteristics. No one product works well in all formulations under all conditions.

The growth of micro-organisms on buildings is a complex interaction of climate, airborne matter, building design, building substrate, local community of micro-organisms, the paint formulation, and application. Knowledge of the influence of these factors is important in formulating a high-quality product and satisfying the expectations of the building owner.

### 8.3 TYPES OF ADDITIVE: WET-STATE PRESERVATIVES

The primary need for most aqueous coatings is protection against bacteria. Fungi usually will not grow in coatings with the exception of occasional yeast contamination. Gram-negative bacteria (gram-negative bacteria do not absorb a standard dye, iodine/crystal violet, and become stained) have cell walls that are less permeable than gram-positive bacteria (will absorb a standard dye) and are, therefore, more difficult to kill with toxicants.

*Pseudomonas aeruginosa* is the most common bacterial organism that spoils paints. Often, there are other bacterial organisms as well such as *Enterobacter* sp. *Bacillus subtilis*, and other *Pseudomonades*. Anaerobic bacteria could also be present [20]. Therefore, in addition to activity against the standard spoiling organisms, a wet-state preservative must also have broad activity against the less common organisms as well.

The most common types of bactericide used in coatings are the formaldehyde-releasing products and the isothiazalone (isothiazalin-one)-based compounds. Formaldehyde itself does not work well as a wet

state preservative for coatings because it is too volatile and too reactive. It reacts with amines and is easily oxidized. Compounds that release formaldehyde slowly or under certain conditions are most frequently used in coatings. It is the electrophilic character of formaldehyde that makes it effective, reacting with nucleophilic cell components that have amino or thiol groups. Formaldehyde blocks the synthesis of methionine by reacting with homocysteine that the cell produces as a methionine precursor [21,22].

The range and variety of compounds that release formaldehyde is enormous. However, most of the compounds used in the coatings industry are condensates of formaldehyde and amines. These include the triazines, the quaternary hexaminium salts, and the oxazolidines.

### 8.3.1 Triazine

One of the simplest and highest in available formaldehyde of the common coatings preservatives is hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine (also known as just triazine). It is formed by the condensation and trimerization of ethanolamine and formaldehyde. This compound is sometimes inaccurately referred to commercially as 2-(hydroxymethyl)amino ethanol, which is really just an intermediate that quickly trimerizes to the triazine structure. It is stable at alkaline pH, but releases formaldehyde under acid conditions. Normally, aqueous coatings are on the alkaline side, but bacteria will release acidic metabolites and trigger a localized release of formaldehyde in the presence of triazine.

Triazine may contribute a slight yellowing in a white paint due to breakdown to ethanol amine. Ethanol amine will develop an amber color over time. The reaction of amine with monomer and/or residual redox activator is also a possible cause of yellowing. This problem is overcome by using an amine that is color stable such as amino methyl propanol.

### 8.3.2 Oxazolidines

When secondary amines like 2-amino-2-methyl propanol are reacted with formaldehyde, oxazolidines are formed—in this case, 4,4 dimethyl 1,3 oxazolidine. This is a widely used preservative in the coatings industry. Like the triazine compound, it is sometimes inaccurately referred to as something else in commercial products. The 4,4 dimethyl 1,3 oxazolidine is sometimes referred to as 2(hydroxymethyl)amino-2-methyl propanol. The true structure is the 1,3 oxazolidine. Oxazolidines are more color stable than triazine (hexahydro-1,3,5-tris(2-hydroxymethyl)-s-triazine) but not quite

as effective due to slightly less available formaldehyde. The oxazolidines are also slightly higher in cost than triazine. Like triazine, oxazolidines release formaldehyde under acidic conditions.

### 8.3.3 Quaternized Salts of Hexamethylenetetramine

One of the first synthesized formaldehyde-releasing compounds was hexamethylenetetramine (HTA). This was the simple condensation reaction of mixing ammonia with formaldehyde. To increase effectiveness in alkaline media, the HTA is quaternized [23]. The quaternized hexaminium salts release formaldehyde in aqueous solutions independently of the pH. Although the quaternized hexaminium salts have a weak cationic character, they are compatible with anionic compounds and have been used for many years in aqueous paint formulations. Traces of monomer will react with the amine and lead to slight yellowing of white paints. Quaternized hexaminium salts do not partition into the organic phase. The triazines and oxazolidines will partition into the organic phase to a slight degree. The most common quaternized hexaminium salts used in coatings are 1-(3-chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride and methyl-3,5,7-triaza-1-azoniaadamantane chloride.

### 8.3.4 Bronopol

Bronopol (2-bromo-2-nitropropane-1,3-diol) is a compound that has a minor role as a preservative in coatings in the United States. In Europe, it is more common and used in blended products, usually in conjunction with isothiazalones. Bronopol will slowly release formaldehyde in alkaline environments. The activated bromine also acts as a toxophoric group. Some discoloration and corrosion may occur on degradation and release of bromide.

The formaldehyde-releasing preservatives have good efficacy against the bacteria that causes spoilage in aqueous paints. However, because formaldehyde is toxic and a suspected carcinogen and not very effective against fungi, other non-formaldehyde-releasing compounds are often used in paints instead.

### 8.3.5 Isothiazalones

The isothiazolone (isothiazolin-one)-based compounds do not release formaldehyde. The most common isothiazalones used in coatings are 2-methyl-4-isothiazalin-3-one, 5-chloro-2-methyl-4-isothiazalin-3-one, and 1,2-benzisothiazalin-3-one. Usually the 2-methyl-4-isothiazalin-3-one (MIT)



and 5-chloro-2-methyl-4-isothiazalin-3-one (CMIT) are used as a mixture. The CMIT is much more effective against fungi and bacteria than the MIT, but it is also a much more potent sensitizer than MIT. Concentrations as low as 20 ppm of the mixture are often enough to preserve an aqueous paint. Stability of isothiazolones is not very good. Amines, sulfides, sulfites, thiols, and oxidizing and reducing agents all deactivate MIT and CMIT. The chemical stability of MIT and CMIT is greatly increased by adding a small amount of metal salts, copper being the most effective. Copper salts have also been found to increase the activity of CMIT [24]. Thermal decomposition of both MIT and CMIT starts at about 55°C. Thus, the value of the mixture is for a formaldehyde-free preservative that will protect the paint until it is opened. Once the paint has been opened and used, contamination of the unused portion may occur.

Benzisothiazolone (1,2-benzisothiazolin-3-one), also known as BIT, is much more stable than MIT or CMIT both chemically and thermally; however, its activity is not as good. Somewhat higher concentrations must be used, but stability in the paint is generally better. BIT is also a skin sensitizer, although not as potent as CMIT. However, BIT must be used at higher concentrations than CMIT to achieve desired preservation performance. Chlorination of isothiazolones results in greater potential for skin sensitization.

### 8.3.6 1,2 Dibromo-2,4-dicyanobutane

A non-formaldehyde-releasing, non-isothiazolone preservative that finds some use in coatings is 1,2-dibromo-2,4-dicyanobutane (DBDCB). The solubility in water is low (3.8 g/L) for an aqueous preservative, but still finds use in some applications. It is stable up to about pH 9. It does not have the toxicity and sensitization issues of the formaldehyde releasers and isothiazolones, respectively, but, typically, it is not as effective in most coatings applications. DBDCB is often blended with other wet-state preservatives such as bronopol or isothiazolones.

## 8.4 TYPES OF ADDITIVES: DRY-FILM PRESERVATIVES

Dry paint films, especially exterior paint films in most climates, need to be protected against the growth of micro-organisms. In North America, fungi cause most of the problems with discoloration and degradation of exterior paint films, particularly over painted wood. Masonry is less susceptible to fungal growth because of the alkaline nature and lack of nutrients. On the

other hand, masonry is likely to support algae growth due the higher tolerance to alkalinity and lack of competition from fungi.

The number of suitable organic dry-film preservatives for decorative coatings is not very large and none will last more than a few years under harsh conditions. Inorganics are more durable, but efficacy is not as good. Using both often results in good performance. Most dry-film preservatives only have activity against fungi; a few are active against both fungi and algae, notably the pyrrithiones and isothiazolones. The toxicity of the preservative together with its solubility in water and water-miscible components of the paint, and the porosity and hydrophobicity of the paint film will determine how well the film remains free of microbial growth. A recent trend in the United States has been to follow the Europeans in blending products to broaden the spectrum of activity.

### **8.4.1 Carbamates**

#### **8.4.1.1 3-Iodo-2-propynyl butylcarbamate**

One of the most commonly used dry-film fungicides for coatings is 3-iodo-2-propynyl butylcarbamate (IPBC). It is suitable for both waterborne and solvent-borne architectural coatings and wood treatments. IPBC has a very broad spectrum of activity against the fungi. It is very effective against yeast, mold, stain fungi, and rot fungi. Against algae, IPBC has some weak activity.

3-Iodo-2-propynyl butylcarbamate is available in a number of solvent carriers at various active concentrations as well as a 97% active powder. Typical concentrations used in coatings range from 0.1% to 0.4% active on the weight of wet paint. The use levels for wood treatment products are typically slightly higher. The type of solvent carrier will have an effect on the following:

- The package stability of the IPBC
- How the IPBC partitions between the water and polymer in water-based coatings
- How deep the IPBC penetrates into the substrate
- The migration out of the paint film
- The distribution of IPBC through the paint film

The type of solvent used to dissolve the IPBC should be considered a formulation variable that will affect the performance of the coating. Aqueous preparations of IPBC as dispersions or emulsions are possible but generally do not perform quite as well as the solvent-borne versions.

Degradation of IPBC usually leads to formation of a yellow to brown color, depending on the degradation products and the coating formulation. Degradation can occur on storage and/or by exposure to light. The degradants are usually elemental iodine, iodides, and multiple iodo propynyl butylcarbamate products (di and tri iodo propynyl butyl carbamate). Because of the sensitivity to light, IPBC should be used in pigmented products or in products that will penetrate into the substrate. Roof coatings and elastomeric coatings are often formulated with only 0.25–0.50 lbs of titanium dioxide as the only pigment, which runs the risk of turning a pale yellow within hours in bright sunlight.

#### 8.4.1.2 Carbendazim

Carbendazim is chemically *N*-benzimidazolyl-2-carbamic acid methyl ester (BCM). Carbendazim is one of the most widely used dry-film preservatives around the world, but is not used much in the United States. Carbendazim is a low-cost agricultural fungicide that has been used mostly in blended products. Because carbendazim is not effective against one of the most common types of fungi growing on paint films, *Alternaria alternata*, it is usually blended with 2-*n*-octyl-4-isothiazolin-3-one (OIT). Typically, the amount of OIT in the blended product is not very high, 4–5% plus 10–15% carbendazim. The OIT is much more expensive than the carbendazim. Because algae is recognized as a problem in Europe and Asia, algacides are usually also included in the blend with carbendazim and OIT. Newer products are available where the OIT have been replaced with IPBC, also at low concentrations. The major attraction of carbendazim is its low cost and exterior durability (8 ppm water solubility). The major drawback is the lack of activity against *Alternaria alternata*.

#### 8.4.2 Chlorothalonil

Chlorothalonil (2,4,5,6 tetrachloroisophthalonitrile) is a common dry-film fungicide used in both waterborne and solvent-borne architectural coatings. It has broad activity against most stain and mold fungi, but it is not as effective as IPBC against rot fungi. Chlorothalonil is also effective against algae, but has poor efficacy against *Chlorella* sp., some of the most common species of algae growing on paint films. Chlorothalonil is available as an aqueous dispersion as well as powdered forms. The powdered forms have to be dispersed using high-shear equipment. The dispersion forms may be added to the letdown.

Chlorothalonil reacts with nucleophilic microbial cell entities, such as thiol groups, and is deactivated in doing so. Hydrolysis occurs at high pH, about 8.5, and increases with increasing pH. At pH 9.0, the half-life is 38 days. Aqueous paints that contain chlorothalonil must be formulated no higher than 8.5 and should not be applied over alkaline substrates such as masonry.

The water solubility is very low, about 1 ppm at neutral pH. Therefore, resistance to leaching from the paint film would be expected to be good. However, the solubility in common paint solvents such as propylene glycol and coalescent agents can be several percent, and could contribute to early loss due to leaching of some of the chlorothalonil.

The major negative in using chlorothalonil for coatings is the tendency to cause erosion (chalking) of the paint film on exposure to light for long periods of time. For this reason, chlorothalonil is used mostly in white and off-white paints and seldomly used in colored paints, unless at low concentrations.

### 8.4.3 Folpet

Folpet (trichloromethylthiophthalimide) is a fungicide that is only used for solvent-borne coatings. Folpet is easily hydrolyzed, and the rate increases with increasing pH, so it is unsuitable for waterborne products. It is widely used as a surface fungicide in conjunction with IPBC for wood treatment products such as transparent and semitransparent wood stains. The IPBC penetrates into the wood, due to its solubility in the hydrocarbon carrier, and the folpet remains on the surface. Solvent-borne paints that use Folpet should be low in moisture content because folpet will hydrolyze easily, even with a small amount of water.

### 8.4.4 Isothiazolones

Methyl and chloro methyl isothiazolones are used for preservation of paints in the wet state and are water soluble. By increasing the length of the alkyl chain on the N atom, the water solubility is significantly reduced, allowing use for dry-film preservation of exterior paints. The water solubility can be further reduced by chlorination. Chlorination also increases the toxicity. However, at the same time, chlorination increases the potential for skin sensitization.

#### 8.4.4.1 2-*n*-Octyl-4-isothiazolin-3-one

The most common isothiazolone used for film preservation is 2-*n*-octyl-4-isothiazolin-3-one (OIT). It has been used for many years and is not known

to discolor paint films like some of the other dry-film fungicides available. The problem with OIT is stability and water solubility. Stability in the presence of primary and secondary amines as well as oxidizing and reducing agents is not very good. Zinc oxide is used to stabilize OIT in the presence of amines, usually at a concentration of about 2–2.5% of the weight of the wet paint. The water solubility of OIT is somewhat high for exterior applications, about 460–480 ppm. The OIT can leach out of a porous paint film if exposed to substantial rain. Lengthening the alkyl chain will decrease the water solubility, but at the expense of antimicrobial activity. OIT is also quite soluble in common paint solvents like propylene glycol and common paint coalescent agents. Additional OIT loss can occur with the leaching out and evaporation of the glycols and coalescent agents in typical coatings. Because of the alkaline instability, paints that contain OIT should not be applied over alkaline substrates, like new masonry or cement fiberboard.

#### 8.4.4.2 Dichloro-2-*n*-octyl-4-isothiazolin-3-one

Substitution of the isothiazolin-one ring with chlorine led to the development of 4,5 dichloro-2-*n*-octyl-4-isothiazolin-3-one (DCOIT) [25]. DCOIT has a much lower water solubility than OIT (about 2 ppm) and is more likely to remain in the paint film on weathering. Because of the activated chlorine, DCOIT may be more toxic than the OIT, but also more of a skin sensitizer. DCOIT, like OIT, is not very stable in the presence of amines or in alkaline environments.

### 8.4.5 Pyrithiones

#### 8.4.5.1 Zinc Pyrithione

The most common pyrithiones used in coatings are the zinc and copper pyrithiones (2-mercaptopyridine-*N*-oxide or 2-pyridinethiol-*N*-oxide). Zinc pyrithione is used in both architectural and antifoulant coatings. Copper pyrithione is almost exclusively used in antifoulant coatings because of its green color. Zinc pyrithione is white. Both are very effective fungicides and algaecides with very low water solubility. The solubility of dry-film preservatives in water and in the common solvents used in emulsion coatings (coalescent agent, glycols, surfactants, and defoamers) adversely affects the durability of the preservative in the coating, allowing the preservative to leach out more quickly.

The water and solvent solubility of zinc pyrithione is among the lowest of all the dry-film preservatives available. This is contributing factor to the



very good long-term performance of zinc pyrithione compared to many other compounds.

Pyrithiones complex strongly with transition metals, copper being the most stable. Zinc pyrithione is close in formation constant value to ferric pyrithione and cobalt pyrithione. Therefore, when iron or cobalt is present in a coating formulation, some transchelation may occur. Zinc pyrithione is not used in alkyd paints due to the presence of a cobalt drier catalyst. Extender pigments such as calcium carbonate may contain several hundred parts per million of iron. Dissolution of that iron could occur and react with zinc pyrithione to cause discoloration. Ferric pyrithione is blue/gray in color. Some latex emulsions also have small amounts of iron present. Iron(II) sulfate heptahydrate is often used as an activator for redox initiator systems. Prevention of ferric pyrithione formation in the coating is easily accomplished by the addition of about 0.05% zinc oxide [26]. Zinc oxide is more soluble at alkaline pH than zinc pyrithione and prevents transchelation, most likely by the common ion effect. Zinc pyrithione is also sold commercially by Arch Chemicals, Inc. with an appropriate amount of zinc oxide mixed in. The product is Zinc Omadine ZOE Dispersion.

Pyrithiones are alkaline stable, which makes them a good choice for use in masonry paints. Most organic dry-film preservatives are not stable at pH much greater than 9.0. Typical dosage for zinc pyrithione is 0.2–0.4% active by weight of wet paint.

#### 8.4.5.2 Sodium Pyrithione

Sodium pyrithione is also used as a dry-film preservative as well as for preserving in the wet state. Sodium pyrithione is water soluble and effective against bacteria when used in coatings at over 600 ppm active. If zinc oxide is also present in the coating formulation, then the sodium pyrithione will react with the zinc oxide to become an insoluble zinc complex that will provide dry-film protection against the growth of both fungi and algae [27]. For dry-film protection, more than 600 ppm is necessary—usually at least 1600 ppm is required. By using sodium pyrithione at over 1600 ppm (active) and zinc oxide at over 2.0% by weight on wet paint, effective wet-state and dry-film preservation can be achieved without adding any VOC to the coating formulation.

#### 8.4.6 Azoles

Tebuconazole and propiconazole are fungicides used mostly for preservation of wood against wood-destroying (decaying) fungi. They are less effective against the staining fungi. Because they are only moderately

effective against *Alternaria alternata*, one of the more prevalent invaders of paint films, their use is mostly restricted to wood treatment products.

Thiabendazole (TBZ) also is not very effective against *Alternaria alternata*. It works best if used in combination with fungicides that are effective against *Alternaria alternata*. Also, the high cost of thiabendazole limits its use in coatings.

#### 8.4.7 Diiodomethyl-*p*-tolylsulfone

Diiodo-*p*-tolylsulfone is a broad-spectrum fungicide, effective against the common organisms that grow on paint films. The very low water solubility, about 1 ppm, is good for exterior durability. Unfortunately, discoloration due to the iodine content makes it a poor choice for white and light-colored paints. Its alkaline stability is good up to about pH 10.

#### 8.4.8 Blends of Dry-Film Preservatives

For many years, blends of dry-film preservatives have been used in Europe and Asia in preference to single actives. The main reason blends that have not been used in the United States has been due to regulatory costs. In the United States, each blend would have to be registered separately with the EPA. Blending broadens the spectrum of activity of the preservative product. A typical blend would have a low-cost fungicide such as Carbendazim, a higher-cost fungicide to address the activity gaps of the Carbendazim, and an algaecide. Another reason that blends have been popular outside the United States is testing philosophy. Europe and Asia have typically put more faith in laboratory test results than field test results. The rationale has been to have better control of the experiment. U.S.-based workers have typically put more faith in field test results, believing that actual dynamic weathering conditions cannot be accurately duplicated in the lab. Standard, repeatable laboratory tests using the same organisms for all the testing is conducive to designing blended products to pass the lab tests rather than perform well in the field. As in the previously mentioned example of the blend of carbendazim, OIT, and algaecide (Diuron), the OIT is added at a low level (typically 4–5%) to cover the gap in the Carbendazim activity against *Alternaria alternata*. The 4–5% of OIT is sufficient to pass the laboratory test, but is not likely to provide much protection for the paint film in actual outdoor conditions. Many of the blends available are similar to the above example. Sometimes, OIT is replaced with IPBC and Diuron is replaced with another algaecide (herbicide). Blends are becoming more widely available in the United States as an attempt to offer new products to the paint industry because it is unlikely that any new molecules will be coming along soon.

### 8.4.9 Algaecides

Both the pyrrithiones and isothiazalones are effective algaecides as well as fungicides. The most common use of algaecides in coatings is for the antifoulant market. Algae commonly grows on painted buildings, but is not as widely recognized as a problem as mildew growth is.

The only purely algaecidal compound registered in the United States for coatings applications is 2-methylthio-4-*tert*-butylamino-6-cyclopropylamino-*s*-triazine. It has a low water solubility of about 7 ppm, so it is suitable for antifoulant coatings. Use in architectural coatings could cause problems because as an herbicide, damage to plants may occur from leaching out of paint films and into gardens. Usually, the better choice would be zinc pyrithione or DCOIT because neither is a herbicide and both have good activity against fungi as well as algae. 2-Methylthio-4-*tert*-butylamino-6-cyclopropylamino-*s*-triazine is used in some blended products and it is also available as a single active.

## 8.5 TEST METHODS

### 8.5.1 Wet State

For aqueous coatings, bacterial contamination is much more of a problem than fungal contamination. ASTM D2574, Standard Test Method for Resistance of Emulsion Paints in the Container to Attack by Microorganisms is commonly used to determine if the coating is susceptible to microbial growth. *Pseudomonas aeruginosa* and *Enterobacter* sp. are specified in the method to be the test organisms, but may be substituted with other organisms if appropriate. These two organisms are generally regarded as common in paints [28]. Other variations include acclimating the organisms to the paint by inoculation of unprotected paints and using the paint itself as the inoculum for the test samples. Alternately, naturally spoiled paint could also be used for the inoculum. Multiple challenges are suggested, usually two to six. Viability of the bacteria is determined 1 day and 1 week after each challenge. Once it has been determined what concentration of bactericide is adequate to protect the paint, a safety factor of 2-3 should be used to finalize the correct dosage to provide protection under most conditions.

### 8.5.2 Dry Film

For laboratory evaluations, ASTM D5589-97, Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Algal Defacement, and ASTM D 5590-94, Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement



by Accelerated Four-Week Agar Plate Assay are the two most common agar plate methods for determining the effectiveness of dry-film preservatives. They are quick and have good reproducibility. The option of preleaching the samples for several days is described in the two standards. Preleaching is a good idea for any type of coating that will be subjected to rain or wet conditions. A standard inoculum is suggested, but flexibility to use other organisms is provided for. An additional organism that should be considered for testing is *Alternaria alternata* because it is well known to be among the first colonizers of paint films [29]. For agar plate methods, the inoculum is directly applied to the test specimens.

A slower method, but one that naturally inoculates the test specimens, makes use of an environmental chamber. ASTM D3273-86, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber. This method suggests a test period of 4 weeks, but up to 10 weeks is not uncommon because growth on negative controls often does not start for several weeks. The inoculum uses the same organisms as the ASTM D 5590 protocol, but instead of direct inoculation, the organisms are added to soil in the bottom of the chamber and inoculation occurs by airborne spores. There is no mention of preconditioning of the samples, but for testing exterior coatings, leaching before running the test could provide more realistic results.

The benefit of laboratory evaluations is that they can be controlled and results are usually repeatable, especially the agar plate methods. However, because growth of organisms on paint films is a dynamic event, where growth is occurring simultaneously with weathering, laboratory testing cannot accurately simulate actual outdoor conditions. Products may perform very well in laboratory testing and not well in actual outdoor testing. Laboratory tests are good for screening because if a product performs poorly in the lab test, it likely will not perform well in actual use. However, the reverse is not always true.

Actual outdoor exposure of painted panels is generally considered to be the best indicator of what to expect of a dry-film preservative. The importance of carefully designing and preparing a field exposure of paint panels cannot be overemphasized. Valuable information about the performance of a paint film under actual conditions takes much time and work and should reward the experimenter with good, useful data. ASTM D 3456, Standard Practice for Determining by Exterior Exposure Tests the Susceptibility of Paint Films to Microbiological Attack and ASTM D 1006-93, Standard Practice for Conducting Exterior Exposure Tests of Paints on Wood provide very good background information for designing a proper exposure study. The substrate and primer can have a significant effect on the degree of microbial growth on the surface of a paint film.

Careful selection of the types of substrate, layout of the paints on the panels, and appropriate use of primers will help in minimizing the biases they can cause in the results.

### 8.5.2.1 Wood

Wood substrates contain nutrients, are porous, and retain moisture, typically 15–25% by weight. The sapwood is more conducive to mildew growth than the heartwood due to the greater concentration of nutrients and the lower dimensional stability of the sapwood. The lower-dimensional stability can lead to microcracking of the paint film and, therefore, greater access to the substrate. The nutrient value, degree of moisture absorption, and dimensional stability will all influence the degree of fungal growth on the surface of the paint. These variables can be quite different from one piece of wood to another of the same species and can also vary along the length and width of a 6 in. by 36 in. board!

To minimize the influence of variability of the wood substrate, at least three boards are always recommended, with all the paints to be compared applied on the same board. A positive control, negative control, and up to four experimental paints can normally be applied to a 3-f board.

White pine is commonly used, unprimed, with two coats of each paint applied at equal spreading rates. White pine (*Ponderosa*) is used mostly for millwork and building details such as fascia boards, soffits, and wood columns. It is also sometimes used for clapboard siding. White pine has a higher nutrient content than cedar or redwood, is also more dimensionally unstable, and will mildew faster than cedar or redwood. Cedar is a very common siding material and should be included in any mildewcide study as well as pine. Cedar must be primed to prevent bleeding of water-extractive tannins in the wood. One coat of primer and one topcoat of the experimental paint is a common practice. The primer should not contain a fungicide, unless the study is designed for evaluating a system.

Boards are flat-sawn, quarter-sawn, or somewhere in between (bastard-sawn). Quarter-sawn are the most dimensionally stable and should be used whenever possible. ASTM D 358-93 Standard Specifications for Wood to Be Used as Panels in Weathering Tests of Coatings provides good suggestions for selecting wood for exposure testing.

### 8.5.2.2 Masonry

Masonry does not provide any organic nutrients for mildew. It does provide trace minerals that algae and fungus need. The high pH and low moisture retention of masonry inhibits the growth of micro-organisms. The high pH can accelerate the hydrolysis of some dry-film preservatives. This can lead to

yellowing and loss of efficacy. Because masonry is a common building material, especially in geographic areas most prone to mildew and algal growth, masonry panels should also be included in a study that evaluates dry-film preservatives. Masonry is much more consistent in composition than wood. Usually, two replicates are sufficient to provide consistent results. However, again, it is a good idea to have all of the experimental paints in a group on the same panel because position on a rack (height off the ground) can influence the growth of mildew and algae. Calcium silicate boards or stucco-coated calcium silicate boards are commonly used masonry substrates for outdoor exposures. Two coats of the finish paint with no primer is the preferred system for evaluating pH stability of the mildewcide. Priming the stucco panels with an acrylic sealing primer that contains no fungicide is a good way to determine the performance of a fungicide in a paint film without a significant influence from the substrate or the primer.

Recoat of weathered paint panels is also a good suggestion for evaluation of mildewcides because most painting projects will actually be repainting of walls that were previously painted and weathered.

## 8.6 SUMMARY

For most house paints, the mildewcide additive represents the third most expensive component of the formulation, after the pigment and binder. Typically, \$0.40–\$0.60 per gallon is spent on dry-film preservative. Most of the preservatives on the market have a broad spectrum of activity and are toxic to micro-organisms at low concentrations. However, the behavior of the products in different formulations can vary dramatically. Intuitively, the solubility of the molecules in water and in the various organic materials in the formulation will affect rate of migration of the product out of the paint film and, therefore, affect the durability and efficacy of the product. Ideally, the migration will be fast enough to provide an effective dose of the product on the paint film surface, but slow enough to provide years of service.

Cornish et al. [30] recently reported on the leachability of various fungicides with water and how solubility affects fungicide performance. The paint film becomes susceptible to fungal growth at the point of fungicide depletion. The porosity of the paint film was also studied for the effect on fungicide loss. Porosity of the paint film and water solubility of the fungicide undoubtedly are major factors in the loss of fungicide from the paint film during weathering. Other factors such as the solubility of the preservative in organic additives could also have a dramatic effect on the durability of

the fungicide. For example, propylene glycol is present in most latex formulations at 3–6% by weight on wet paint. The solubilities of several common fungicides in propylene glycol at 25°C are as follows:

3-Iodo-2-propynyl butyl carbamate	>20%
2- <i>n</i> -Octyl-4-isothiazalin-3-one	>45%
Chlorothalonil	2100 ppm
Zinc pyrithione	200 ppm

Because the propylene glycol will be slow to evaporate, the more soluble fungicides could be rapidly depleted from the paint film if there is rain soon after application of the paint to a building. Also, migration of the propylene glycol to the paint film surface during evaporation could create a concentration gradient of fungicide through the paint film. One study measured the concentration gradient of IPBC in a paint film for an acrylic house paint [31]. The IPBC was found to be more concentrated at the surface of the paint film. As a consequence, the IPBC would be more rapidly weathered away than if uniformly distributed through the thickness of the film. The short-term performance would be very good at the expense of the longer-term protection of the paint film.

Other materials in the formulation could also effect the distribution and migration of the fungicide such as coalescent, defoamer, and even surfactants. IPBC is over 20% soluble in octylphenoxypolyethoxyethanol (hydrophobe/lipophobe balance = 13.5).

With all the possible formulation and drying condition variables, it becomes apparent that the more soluble the fungicide is in the various organic additives, the more random the fungicide distribution and migration rate out of the paint film will be. One type of fungicide is not likely to perform best under all conditions in all paint formulations. If the influence of the substrate is also taken into consideration, the situation becomes more complex.

Choosing a dry-film preservative that is not very soluble in any of the organic additives and is relatively low in water solubility would improve the long-term presence of the fungicide in the paint film. Thus, minimize the randomness of the distribution of the fungicide in the film. Still, the fungicide would have to migrate out of the paint film fast enough to maintain a toxic level on the surface of the paint film. The dry-film preservative zinc pyrithione has low solubility in all of the common organic paint additives and also has a low water solubility of 8 ppm at neutral pH. Zinc pyrithione typically provides very good long-term protection in flat paints. However, in gloss paints, a fungicide like IPBC that migrates faster generally provides better protection than zinc pyrithione due to the lower porosity of the film.

## APPENDICES

## Appendix 8.1 Common Wet-State Preservatives for Coatings: Bactericides

Compound	Common name(s)	Trade names(s)	Company	Properties	Dose range (% by wt.)
2-Bromo-2-nitropropane-1,3-diol	Bronopol	Bioban BPM (99%) Bioban BP 40 (40%)	Dow Chemical Dow Chemical	Formaldehyde release	0.1–0.5%
1,2 Benzisothiazolin-3-one	BIT	Acticide BW20 (20%) Proxel GXL (19.3%) Mergal K10N (9.5%) Nipacide X (18%) Nuosept 495 (19%)	Acti-chem (Thor) Avecia Troy Chemical Clariant Corp. ISP	Isothiazolone more stable than CMIT/MIT blend	0.1–0.3% of 20% solution
Mix 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazoloin-3-one	Kathon CMIT/MIT	Acticide DC Busan 1078 Bioban 2000 Kathon 886 MW 1.5% Mergal K9N Nipacide CI 15	Acti-chem (Thor) Buckman Labs Dow Chemical Rohm & Haas Troy Chemical Clariant Corp.	Blend of isothiazalones	0.1–0.3% of 1.5% solution
4,4 Dimethyl 1,3 oxazolidine		Bioban CS-1135 (76%) Nuosept 101 (77%) Troysan 186 (68%) Troysan 192 (74%)	Dow Chemical ISP Troy Chemical Troy Chemical	Formaldehyde releaser	0.1–0.4%
Oxazolidine mixture		Nuosept 95 (50%)	ISP	Formaldehyde releaser	0.1–0.4%

## Appendix 8.1 Continued

Compound	Common name(s)	Trade names(s)	Company	Properties	Dose range (% by wt.)
Hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine	Triazine	Triadine 174 (78%) Troysan 174 (78%) CanGuard 454 (78%) Nuosept 91 (78%) Dowicil 75 (64%)	Arch Chemicals Troy Chemical Dow Chemical ISP Dow Chemical	Formaldehyde releaser	0.1–0.4%
1-(3-Chloroallyl)-3,5,7-triaza-1-azoniaadamantane chloride				Formaldehyde releaser	0.05–0.2%
Methyl-3,5,7-triaza-1-azoniaadamantane chloride		Busan 1024 (18%)	Buckman Labs	Formaldehyde releaser	0.1–0.5%
1,2 Dibromo-2,4-dicyanobutane	DBDCB	Tektamer 38 (98%)	BASF	Non-formaldehyde; Non-isothiazolone	0.1–0.5%



**Appendix 8.2** Common Dry-Film Preservatives for Coatings: Single Actives

Compound	Common name(s)	Trade names(s)	Company	Properties	Dose range (% by wt.)
2,4,5,6 tetrachloroisophthalonitrile	Chlorothalonil	Acticide C40 (40%)	Acti-chem (Thor)	Slight yellowing; possible pinking with formaldehyde donors; chalking and fading on weathering	0.5–1.2% as active
		Acticide C 98 (98%)	Acti-chem (Thor)		
		Busan 1192 (98%)	Buckman Labs		
		Busan 1192D (40%)	Buckman Labs		
		Nuocide 404D (40%)	ISP		
		Nuocide 960 (96%)	ISP		
		Nopcocide N-40-D	Cognis		
2- <i>n</i> -octyl-4-isothiazolin-3-one	OIT Octyl isothiazalone	Nopcocide N-98	Cognis	Degraded by sulfides and amines	0.1–0.4% as a 45% solution
		Skane M-8 (45%)	Rohm & Haas		
Trichloromethylthiophthalimide	Folpet	Acticide 45 (46.5%)	Acti-chem (Thor)	Solvent-borne only; hydrolyzes easily	0.5–1.2% as active
		Fungitrol 11 (88%)	ISP		
3-Iodo-2-propynyl butylcarbamate	IPBC	Fungitrol 11-50 (44%)	ISP	May cause yellowing in wet state and dry film; can corrosion possible	0.2–0.5% based on active
		Omacide IPBC 20	Arch Chemicals		
		Omacide IPBC 30	ISP		
		Omacide IPBC 40			
		Omacide IPBC 100			
		Fungitrol 420 (20%)			
		Fungitrol 430 (30%)			
		Fungitrol 440 (40%)			
		Fungitrol 400 (98%)			
		Polyphase P20T (20%)			
		Polyphase AF-3 (30%)			
		Polyphase AF-1 (40%)			
		Polyphase P100 (98%)			

## Appendix 8.2 Continued

Compound	Common name(s)	Trade names(s)	Company	Properties	Dose range (% by wt.)
Sodium 2-pyridinethiol-1-oxide	Sodium pyrithione NaPT	Sodium Omadine (40%)	Arch Chemicals	Should use with zinc oxide; for waterborne coatings only	0.1–0.5% as active (0.25–1.25% as supplied)
Zinc 2-pyridinethiol-1-oxide	Zinc pyrithione	Zinc Omadine (95%)	Arch Chemicals	Powder for antifoulant coatings; FPS and ZOE for waterborne only; fungicide, algacide, and bactericide.	2.0–4.0% active for antifoulant
	ZPT	Zinc Omadine FPS (48%) Dispersion			0.1–0.5% active for architectural
		Zinc Omadine ZOE (38%) Dispersion			
Dichloro-2- <i>n</i> -octylisothiazolin-3-one	DCOIT	Sea Nine 211 (30%)	Rohm & Haas	Severe sensitizer	1.0–3.0% active for antifoulants
	Kathon 930	Rosone 2000 (20%)			0.115% active maximum for architectural
	C-9211				



<i>n</i> -Benzimidazolyl- 2-carbamic acid methyl ester	Carbendazim BCM	Mergal BCM (99%)	Troy Chemical	Poor against <i>Alternaria alternata</i> ; used mostly in blends.	0.1–0.5%
Diiodomethyl- <i>p</i> -tolylsulfone		Amical 48 (95%) Amical 50 (75%)	Dow Chemical	Yellowing in wet state and dry film	0.2–0.6% on an active basis
2-(4-Thiazolyl)- benzimidazole	TBZ	Metasol TK-100 (98.5%)	BASF	Poor against <i>Alternaria alternata</i>	0.1–0.3%
2-methylthio-4- tertbutylamino- 6-cyclopropylamino- <i>s</i> -triazine	Irgarol	Irgarol 1071 (98%) Nuocide 1071	Ciba Chemicals ISP	Algaecide only	0.3–2.0-%
Zinc dimethyl- dithiocarbamate	Ziram	MZ-96 (96%)	RT Vanderbilt	Discolors with trace of metals	1.0–3.0%

**Appendix 8.3** Common Dry-Film Preservatives for Coatings: Blends

Compound	Common name(s)	Trade names(s)	Company	Properties	Dose range (% by wt.)
3,4-Dichlorophenyl-1,1-dimethylurea (19%) and 2,4,5,6 tetrachloroisophthalonitrile (14.7%)	Diuron Chlorothalonil	Acticide PM	Acti-Chem (Thor)	Algaecide and fungicide	0.5–2.5%
3,4-Dichlorophenyl-1,1-dimethylurea (19%) and 2,4,5,6 tetrachloroisophthalonitrile (8.8%) and 2- <i>n</i> -octyl-4-isothiazolin-3-one (6%)	Diuron Chlorothalonil OIT	Acticide SR-1216/6	Acti-Chem (Thor)	Algaecide and fungicide	0.5–2.5%
3,4-Dichlorophenyl-1,1-dimethylurea (19%) and <i>n</i> -benzimidazolyl-2-carbamic acid methyl ester (9.9%) and 2- <i>n</i> -octyl-4-isothiazolin-3-one (2.5%)	Diuron Carbendazim OIT	Mergal S-89	Troy Chemical	Algaecide and fungicide	0.4–2.0%
2-Methylthio-4-tertbutylamino-6-cyclopropylamino- <i>s</i> -triazine(4.9%) and <i>n</i> -benzimidazolyl-2-carbamic acid methyl ester (9.9%) and 2- <i>n</i> -octyl-4-isothiazolin-3-one (4.5%)	Irgarol  Carbendazim OIT	Mergal S-90	Troy Chemical	Algaecide and fungicide	0.4–2.0%
2-Methylthio-4-tertbutylamino-6-cyclopropylamino- <i>s</i> -triazine (15%) and 3-iodo-2-propynyl butylcarbamate (15%)	Irgarol IPBC	Polyphase 587	Troy Chemical	Algaecide and fungicide	0.4–2.0%

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2-Methylthio-4-tertbutylamino-6-cyclopropylamino- <i>s</i> -triazine (10%) and 3-iodo-2-propynyl butylcarbamate (20%)	Irgarol IPBC	Polyphase 588, Polyphase 600	Troy Chemical	Algaecide and fungicide	0.4-2.0%
2-methylthio-4-tertbutylamino-6-cyclopropylamino- <i>s</i> -triazine (24%) and 3-iodo-2-propynyl butylcarbamate (4.8%)	Irgarol IPBC	Polyphase 598	Troy Chemical	Algaecide and fungicide; mostly an algaecide	0.4-2.0%
2-Methylthio-4-tertbutylamino-6-cyclopropylamino- <i>s</i> -triazine (4.0%) and 3-iodo-2-propynyl butylcarbamate (4.0%) and <i>n</i> -benzimidazolyl-2-carbamic acid methyl ester (12.0%)	Irgarol IPBC Carbendazim	Polyphase 662	Troy Chemical	Algaecide and fungicide	0.4-2.0%
3-Iodo-2-propynyl butylcarbamate (5.0%) and <i>n</i> -benzimidazolyl-2-carbamic acid methyl ester (15.0%)	IPBC Carbendazim	Polyphase 678	Troy Chemical	Fungicide	0.4-2.0%
3,4-dichlorophenyl-1,1-dimethylurea (15%) and 3-iodo-2-propynyl butylcarbamate (3.0%) and <i>n</i> -benzimidazolyl-2-carbamic acid methyl ester (9.0%)	Diuron IPBC Carbendazim	Polyphase 663	Troy Chemical	Algaecide and fungicide	0.4-2.0%

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