For over 85 years, ACI Committee 515, Protective Systems for Concrete, has been reviewing information regarding various protective systems as well as materials deleterious to concrete. Founded in 1936 as ACI Committee 616 (becoming ACI Committee 515 circa 1966), the committee has published guide documents to support the industry in protecting concrete from deterioration and damage when exposed to such materials as acids (Fig. 1), salts, food waste products, or other chemicals. Concrete durability and resistance to chemical attack (Fig. 2) are dependent upon the concrete itself, including the constituent materials, proportioning, mixing, and placement. However, to enhance or extend the service life of concrete structures, a protection system is necessary to provide a barrier to prevent contact with deleterious materials. The protection system itself must also be durable and effective in the concrete’s environment. Currently, the mission of ACI Committee 515 is to develop information and report on protective systems for concrete surfaces and has two published documents: ACI PRC-515.2-13, “Guide to Selecting Protective Treatments for Concrete”1 and ACI PRC-515.3-20, “Guide for Assessment and Surface Preparation for Application of Protection Systems for Concrete.”2

ACI PRC-515.2-13 provides detailed information on available protective systems and deleterious materials. This publication is popular within the industry because its tables document the effects of various chemicals and how protective treatments prevent deterioration and damage to concrete surfaces. In addition, the document offers descriptions of over 25 generic protection systems. It is a helpful guide for anyone looking to understand the effect of exposure to chemicals and how to prevent potential damage or deterioration to concrete, whether for new construction or repair. The evolution of this document offers an interesting look through the history of ACI Committee 515, as well as the development of knowledge...
Within the entire industry. This article summarizes the history, background, tables, and information found within ACI PRC-515.2-13 and of the Committee itself.

Previously Issued Documents

“The Nature of Portland Cement Paints and Proposed Recommended Practice for Their Application to Concrete Surfaces” from 1942 appears to be the first document published by ACI Committee 616.6 It is interesting to note that of the 13 members of ACI Committee 616, only nine approved of the report. Two disapproved and two refrained from voting.

This report covers the definitions, recommended uses, durability, surface preparation, and curing of both the commercial composition products as well as mixed paint. A great deal of the document also discusses the ingredients used in preparing these compositions and their function. Federal Specification TT-P-21, “Paint, Cement-Water, Powder, White and Tints (For Interior and Exterior Use),”4 from 1941, is cited in the ACI document and seems to contain much of the same information.

The document was revised and reissued in 1949 as ACI 616-49, “Recommended Practice for the Application of Portland Cement Paint to Concrete Surfaces.”5 The document was published as a standard at the 1949 ACI Convention and is similar to the previous 1942 document. It deals with the application, composition, and durability properties of cement-based paint used over concrete for waterproofing and briefly addresses the addition of pigments for producing colors.

Another document developed by ACI Committee 616, and published in 1957, was “Guide for Painting Concrete (For Paints Other Than Portland Cement Paint).”6 This report describes types of paints, other than portland cement paint, commonly used on concrete. It reviews procedures for preparing the surface, selecting and applying the paint, and for repainting. Dampproofing and waterproofing are discussed briefly. A list of federal specifications for paints suitable for concrete is also included. The 1957 document has three paragraphs about surface preparation because it is a critical step in the application process. Both the 1949 and 1957 documents talk about painting as having some water-repellent capabilities, but do not discuss paint as a protection system. Also of note, G.E. Burnett was a long-serving Chair of ACI 616 and acted as Chair for both the 1949 and 1957 documents, issued 8 years apart.

Evolution of ACI 515.2R

Interestingly, no documentation as to the date of the change from ACI Committee 616 to ACI Committee 515 is available, but it occurred between 1957 and 1966, based on publications. The first publication of ACI Committee 515 was in 1966, “Guide for the Protection of Concrete Against Chemical Attack by Means of Coatings and Other Corrosion-Resistant Materials” (Fig. 3). The report was “intended to serve as a guide prior to consultation with experts regarding the specific situation.” The document notes that if concrete is to be durable, it is required to be of a certain quality defined as adequate strength and low permeability. It references other ACI documents and ASTM documents, some of which we are familiar with—such as ASTM C33/33M, “Standard Specification for Concrete Aggregates.” It also references a document from ACI Committee 201, Durability of Concrete, which includes specific considerations for improving resistance to chemical attack, and a document from ACI Committee 211, Proportioning Concrete Mixtures.

About 40 various protection systems are briefly discussed, including one- and two-component coatings, as well as sheet goods. Most of the document is a guide to the classification of coatings and other barrier materials based on their composition and physical properties. The protective treatments discussed are broadly grouped as thermoplastic or thermosetting coatings, inorganic surface treatments, ceramics, mortars for chemical-resistant masonry, and sheet materials. References for the protection claims, with various treatments, are included in sections discussing protection selection, application, and safety. A glossary of terms (mostly from the National Association of Corrosion Engineers [NACE] International, now the Association for Materials Protection and Performance [AMPP], document “Glossary of Terms Used in Maintenance Painting”9) is included at the end of the main document.

Tables provided about 250 different materials listed alphabetically in an appendix as a guide for protection against specific agents (Fig. 4). Some agents were listed with various concentrations, indicating differing attack aggressiveness, and described in generic terms such as “not harmful,” “disintegrate slowly,” “liquid loss by penetration,” “disintegrates,” or “disintegrates rapidly.” Different treatments were indicated using abbreviations listed in a table and classified as “coatings and surface treatments,” “thicker barriers,” and “mortars.” Superscripts were used for special notation comments listed in another table.

Methods of application, with consideration for both the effectiveness and safety, were also included. In addition, the

Fig. 3: Cover of 1966
ACI Committee 515 report’
The Chair of ACI Committee 515 at the time of publication was William H. Kuennning, who was on the 1957 ACI Committee 616 that oversaw the publication of the painting concrete document. The 1966 document is comprehensive and served as the basis for subsequent documents published by ACI Committee 515.

ACI 515.1R-79, “A Guide for the Use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete,” superseded the previous document from 1966 and was updated and expanded. The 1979 document included a new Chapter 6—Protective Barrier Systems. In addition, there were new chapters added: Chapter 4—Waterproofing Barrier Systems, Chapter 5—Damp proofing Barrier Systems, and Chapter 7—Decorative Paint Barrier Systems. A separate chapter, Chapter 3—Concrete Conditioning and Surface Preparation, was also included because of its relevance to the other chapters. The alphabetical table of chemicals that can attack concrete was moved from the Appendix to Chapter 2, and the cross-reference to recommended protective systems for each chemical was moved to the text description of the treatment. In Chapter 6, Table 6.3 classifies each protective system according to its chemical resistance as “mild,” “intermediate,” and “severe.” A significant amount of additional information on design (including typical details for waterproofing), surface preparation, and construction practices, with a list of material specifications and test methods, was added to the references for each section, with the caution that specific manufacturer’s guidance be consulted for a given treatment.

This document was revised in 1985 with only minor changes in content. The majority of the same committee members from the 1979 edition were still serving. A significant revision of the ACI 515.1R-79(85) document was undertaken by ACI Committee 515 after 1985. However, problems occurred in developing content acceptable to ACI. Revisions to the document were balloted by the committee and submitted to the Technical Activities Committee (TAC) several times. The authors were instructed by TAC to “revise, reballet, and resubmit” (a “3R” response from TAC). This occurred multiple times, and eventually in 1998, ACI 515.1R-79(85) was withdrawn by ACI for being too dated to continue publication.

Meanwhile, in 1981, the Portland Cement Association (PCA) published a 17-page document IS001 titled “Effects of Substances on Concrete and Guide to Protective Treatments.” This document was expanded to 21 pages in 1986, to 23 pages in 1989, and revised to 36 pages in 1997. The 1997 edition was authored by Beatrix Kerkhoff. Later editions of PCA IS001, between 2001 and 2007, were also authored by Kerkhoff and contained sections on 23 protective treatments, including updated descriptions on concrete design, surface preparation, durability, maintenance, and protective treatment selection. Descriptions of some more modern protective systems, such as metalizing and silanes, were included, as was added commentary about coal tar epoxies and other systems. This evolution contained much of the information that was in ACI 515.1R-79(85), but it included an expansion and reorganization of the chemical resistance tables to classify various chemicals according to their functionality (for example, acids, solutions of salts and alkalis, petroleum oils, coal tar distillates, solvents and alcohols, vegetable oils, fats and fatty acids, and miscellaneous substances). The document also indicated the possible protective treatments for the different substances and concentrations. The protective treatments from ACI 515.1R-79(85) were updated with more current technologies, the references were updated, and a thorough review of the factors affecting chemical attacks on concrete was included. This document addressed many of the issues that had been the subject of consternation for ACI Committee 515 in revising their document.

In 2010, PCA allowed ACI to use the contents of IS001 to develop a document that became ACI 515.2R-13. The efforts of ACI Committee 515 were enhanced by collaboration with the Society for Protective Coatings (now AMPP). The resulting document was successfully balloted by ACI Committee 515 and reviewed by TAC. It contained the classified listed chemical resistance tables with guidance on possible protective treatments and updated descriptions of the treatments.

ACI 515.2R-13 was reapproved in 2023.

**Next Steps**

Application of the selected protection system, including preparation of the concrete surface, is critical for the overall system’s effectiveness. Discussion of surface preparation has been included in nearly every document developed and published by ACI Committees 616 and 515. Specifics on surface preparation effectiveness included in the ACI 515.1R-79...
document were removed during the development of the ACI 515.2R-13 document, but the relevance of surface preparation remained important to the committee.

In 2020, ACI Committee 515 produced another document, ACI PRC-515.3-20, “Guide for Assessment and Surface Preparation for Application of Protection Systems for Concrete.” Because proper surface preparation is critical to the long-term performance of concrete protection systems and inadequate surface preparation is one of the most common causes of concrete protection system failures, ACI Committee 515 identified a lack of guidance from ACI on this subject. Therefore, this document provides information and recommendations for the evaluation and preparation of concrete surfaces that are meant to receive a protective system, such as bonded or penetrating surface-applied concrete protection systems.

Currently, ACI Committee 515 is working to continue to improve ACI 515.2R. The committee, with an understanding of the density of information contained within the tables in the current document, does not plan to significantly modify or edit these tables. The research by others is valuable and will be retained in the next revision of ACI 515.2R. The committee is making an effort to reorganize the information on the various protection systems to offer users of the document a more streamlined understanding of the applications, advantages, limitations, and special considerations. The committee is also working to include information on newer technologies as well as to document improved understanding of deterioration mechanisms, including microbially induced corrosion.

References

1. ACI Committee 515, “Guide to Selecting Protective Treatments for Concrete (ACI 515.2R-13),” American Concrete Institute, Farmington Hills, MI, 2013, 26 pp.
2. ACI Committee 515, “Guide for Assessment and Surface Preparation for Application of Protection Systems for Concrete (ACI 515.3R-20),” American Concrete Institute, Farmington Hills, MI, 2020, 20 pp.
8. Technical Unit Committee T-60, “Glossary of Terms Used in Maintenance Painting,” *Materials Protection*, V. 4, No. 1, published by National Association of Corrosion Engineers (now Association for Materials Protection and Performance), Houston, TX, Jan. 1965, pp. 73-78.

Selected for reader interest by the editors.

Fred R. Goodwin, FACI, is retired. He is the former Head of the BASF Construction Chemicals Global Corrosion Competency Center. He is Chair of ACI Task Group 321-TG5, Maintenance, and serves on numerous ACI committees and subcommittees. He received the 2011 ACI Delmar L. Bloem Distinguished Service Award, the 2015 Strategic Development Council Jean-Claude Roumain Innovation in Concrete Award, and the 2016 ASTM C09 Award of Merit. He is also a Fellow of ASTM International and the International Concrete Repair Institute (ICRI).

Ann Harrer is an Associate Principal with Wiss, Janney, Elstner Associates, Inc., Los Angeles, CA, USA. She is the Chair of ACI Committee 515, Protective Systems for Concrete; Co-Chair of ACI Task Group 321-TG5, Guide to Rehabilitation of Historic Concrete; and serves on ACI Committee 364, Rehabilitation, and the Membership Committee. She is a recipient of the 2019 ACI Young Member Award for Professional Achievement. She is a licensed professional engineer in California, Massachusetts, and Nevada.