wet-applied coatings and finishes

FOR COMMERCIAL AND INSTITUTIONAL PROJECTS

COURTESY WIGHTMAN & ASSOCIATES

A colorful hair spa called zoey + joey in Ann Arbor, Mich. "It's a boutique salon that incorporates the simple use of color to support their brand," says Wightman & Associates' Marissa Kovatch. She says she usually specifies certain branded paint products as a basis of design, especially those that meet the VOC limits in LEED. "When we need to have a more open specification we will use Master Paint Institute standards to establish quality," says Kovatch.

LEARNING OBJECTIVES

After reading this article, you should be able to:

+ DISCUSS the key issues related to coating, paint, and sealant specification, including sustainability and air quality considerations.
+ DESCRIBE how green standards, guide specifications and life cycle assessments, and environmental product declarations are used in the context of paint and coating selection and application.
+ LIST typical substrates for coatings, such as concrete and metal, and the key correlated considerations for coating selection.
+ EXPLAIN why in some circumstances it may be better for coatings and paints to be applied in the shop–and in some cases, why the materials might be better treated with anodizing or with no coating at all.

BY C.C. SULLIVAN, CONTRIBUTING EDITOR

The rapid pace of development of improved liquid-applied materials and finishes has given Building Teams new options. These sprayable, paintable, or "gunnable" products can add performance and sustainability benefits and reach new levels of resiliency and durability. Architectural finishes from the paints, coatings, and sealants developed with *nano-enhanced substances* include site- and factory-applied coatings for structural concrete, steel, metal panels, aluminum frames, and other specialty metals.

Fortified with nanoparticles, these assemblies are often stronger, more durable, more resistant to fire, and easier to clean than traditional product, according to the science blog Nanowerk (www.nanowerk.com). Some formulas with low or zero volatile organic compound (VOC) content have proven to be more resilient and stronger than their predecessors. In the case of masonry and concrete, the substances improve flowability and compacting¬¬—traits that improve the application of sealers and decorative finishes.

Nano-enhanced coatings help prevent staining and graffiti. New ultraviolet (UV)-protective compounds are available. These include waterborne varnishes reinforced by cellulose nanocrystals and transparent wood-surface finishes reinforced with nanosilica and nanoclay, according the American Coatings Association's *Journal of Coatings Technology and Research* (paint.org).

Other non-nanotech-based materials offer the possibility of lighter weight, increased strength, flame-retardant ability, and self-healing and resilient qualities. According to the JCTR, such promising materials include *zirconia ions* for reducing corrosion of galvanized steel; *fluorinated coatings* for stone and tile surfaces; *hydrophobic silane–zeolite coatings* to prevent aluminum corrosion; *solar absorber applications* for aluminum and copper; and *coatings with metallic-effect pigments* that offer antimicrobial and electromagnetic shielding properties. These represent potential solutions to common and often intractable material performance problems.

Building Teams are looking for systems to enhance and protect the entire building envelope from the elements, says Richard Koenigsberg, PE, Founder/President of Koenigsberg Engineering (koenigsbergengineering.com). "Every portion of the building's outer structure, from the roof and exterior walls to the basement, can be vulnerable to water intrusion and weathering," he warns. This can lead to wet insulation, air leakage, and premature deterioration of construction materials.

Building owners and developers, especially those with large portfolios of buildings, are shifting their procurement practices toward more durable and sustainable products, says Marissa Kovatch, LEED AP, IIDA Associate and Senior Interior Designer with Wightman & Associates (www.wightman-assoc.com). Institutional and corporate end users have formed the Sustainable Purchasing Leadership Council, whose founding members include the American Coatings Association, the American National Standards Institute, UL Environment, and the U.S. Environmental Protection Agency. The SPLC intends to establish product procurement guidance, notably for what it calls chemically intensive products, for hospitals, schools, and other institutional entities," according to the ACA.

Building Teams are also specifying systems from a single manufacturer whenever possible, especially those that "have experience in dealing with these complex issues and can offer warrantable solutions to all aspects of the building envelope," says Koenigsberg. "They also provide excellent support and will often offer to work with the contractors to make sure they are utilizing their materials properly."

Suppliers can also help with critical variables like substrate analysis and surface preparation specifications, says Tim Weber, BEC, LEED AP BD+C, Project Manager for architecture firm Cordogan, Clark & Associates (www.cordoganclark.com). "Mockups, field adhesion testing, and field coordination meetings provide the opportunity for the coating manufacturers to communicate project- and warranty-related recommendations and concerns directly to the installers, ensuring a proper installation," he says.

COURTESY LOTUSAN

Lotusan nano-coating has a micro-texture that is self-cleaning and beads rainwater. The closeup shows the action of the water on the coating, how it beads up and also removes dirt. PPG and others have developed similar self-cleaning coatings.

MATCHING COATING TO SUBSTRATE

One of the areas of most rapid change in coatings technology is in masonry structures and materials, especially for institutional and multifamily projects. Building Teams are focused on masonry for its inherent durability, resiliency, and thermal mass. In Texas alone, more than 200 communities have adopted new ordinances or initiatives embracing "masonry planning," according to the Brick Industry Association. These zoning rules incorporate safety, energy, or sustainability requirements that can be satisfied by using load-bearing brick, brick veneer, concrete, or other masonry as cladding for new construction projects.

The first step in selecting a suitable masonry coating or sealant product: consideration of the material's properties and limitations.

Concrete: The omnipresent building material. Three tons of concrete are produced and consumed per person every year, making it one of the most commonly used building materials in the world. Concrete's value is derived from its compressive strength, versatility, durability, and availability. It is important that the properties and interactions of concrete with other building materials be reflected in architectural design and specifications.

Concrete tends to deteriorate with age and exposure. Devotees of Brutalism notwithstanding, it is also widely viewed to be visually uninteresting. To add durability, surface treatment may be applied to exposed concrete; to add aesthetic flavor, color may be added, although doing so may actually compromise the concrete's effective life span, according to Scott Paint, a supplier in Sarasota, Fla.

Research by the Portland Cement Association and the National Ready Mix Concrete Association shows that surface moisture intrusion is the most common cause of premature damage in concrete. Surface scaling, mainly from freeze-thaw cycles, may be visible. An alkali-silica reaction may come about when aggregates react with the alkali hydroxides in concrete, causing expansion and cracking over the years, according to the PCA. Chemical intrusion and corrosion of steel reinforcements are two other causes of damage.

According to the PCA, the concrete in reinforced concrete can itself be an agent in corroding the embedded steel, by providing an electrolyte. Rebar is most vulnerable to this kind of reaction in colder and coastal climates. The presence of chemical deicers in cold climates and salts in seawater are a sign of chloride ions in the moisture the concrete absorbs. This acidity weakens the alkaline environment of concrete, which will usually provide a passive, "negligibly reactive" layer that protects rebar in most reinforced systems of this kind. Building Teams should aggressively consider coating options and interactions in colder and coastal climate zones.

Concrete sealers are common in such applications as exposed floor slabs. There are two basic types: *coatings*, known as topical sealers; and *penetrating or reactive sealers*, which must be matched to the concrete's substrate porosity to properly penetrate and react. A common approach for treatment is to apply water-based acrylics,

which protect against the ingress of carbon dioxide and water. "They enhance the aesthetics of concrete and masonry, extend the life of the building, and are crack-bridging and breathable, so they will not act as vapor barriers," says Koenigsberg.

Where a more resistant seal is required, Koenigsberg recommends polyurethane sealants, which have proven to bond well with porous substrates like concrete and brick, even without the use of a primer.

Cordogan, Clark's Weber notes that maintenance practices often determine how resilient the coatings must be. In cases where the owner or operator undertakes deicing on exterior concrete stairs, Weber will often recommend a silane sealer, which is effective for the dense concrete used on façades and parking decks. "Silane sealers fill the pores of the concrete, preventing penetration of the chloride found in common deicing products," he says. Silene sealers are vapor permeable, and will allow any residual moisture in the concrete to dry out over time, he adds.

COURTESY CORDOGAN, CLARK & ASSOCIATES

Illinois State University's Watterson Towers, a 1960s-era dormitory for 2,200 Redbird students. Design firm Cordogan, Clark & Associates determined that proper coating specification was crucial to the success of the massive concrete restoration project.

Brick: Get the detailing right. Silane is also used for dense brick in some instances, although the Brick Industry Association contends that brick should never need a coating to protect the assembly from excessive water intrusion—provided that "proper material selection, detailing, construction, and maintenance have been executed."

The BIA suggests avoiding coating cavity walls or brick veneer in new construction, or on new or existing clay pavers. "A common mistake is applying nonpermeable coatings over materials that are intended to breathe, such as applying latex paint over clay brick," says Wightman & Associates' LaDitka.

The BIA also recommends against using a coating to try to correct water penetration problems. For situations where brick masonry must be coated, the Building Team should provide vents at the top of drainage spaces to help promote moisture evaporation, as some coatings block the natural and beneficial porosity of brick.

Restoring existing masonry. The key to successful coating and sealant applications in restoring existing masonry is to understand the composition of older materials and how they will react to cleaning, repair, and new treatments. For terra cotta exteriors, Koenigsberg advises against using coatings: he prefers to fabricate replacement sections. For exterior concrete restoration, Weber says his firm emphasizes durability over environmental concerns, especially with high-rise projects. "For masonry restoration, sealing brick masonry mass walls has a significant impact on the drying potential of the material and assembly," he says. "Proper exterior maintenance such as tuck pointing and ensuring the walls are properly flashed typically yields better results."

Weber points to his firm's plan for restoring the exterior of Illinois State University's Watterson Towers, built in the 1960s. "We had to consider that the concrete material changes over that much time," he says. "We needed to be certain how the coating and concrete would interact." Weber's team considered a highly water-repellent yet vapor-permeable coating that would minimize contact area for water and dirt. The project will be completed over a 30-month period; the 2,200 ISU students will remain in their residences as the work is completed.

Improving energy performance can be a factor in coating and sealant specifications, as Stuckey Construction and Bleck & Bleck Architects found in the renovation of the Muller Trading Company Building, a historic structure from the 1800s in Libertyville, Ill. The team applied a thin layer of a nano-based interior coating (Nansulate Translucent GP) with very low thermal conductivity to the masonry walls to inhibit heat transfer. The result: reduced energy consumption, enhanced thermal resistance, better resistance to UV and moisture.

"Infiltration can be addressed with various coatings, but until recently nothing could be done about thermal transmission," wrote Robert Bleck, AIA, LEED AP, Partner in Bleck & Bleck (bleckarchitects.com), in an article in *Masonry Edge*. The coatings used have been tested in other applications to reduce thermal movement by about 30%, says the architect. The clear, matte-finish formula can also lower surface temperatures and reduce heat emitted into the environment, making it also beneficial for metal surfaces. The manufacturer states that the product can be painted over.

In many cases, fundamental degradation is the problem, even for well-designed older buildings. Bellaire Tower, the 1930 Art Deco landmark high atop Russian Hill in San Francisco, is well known from its cameo appearance in Alfred Hitchcock's "Vertigo." Hundreds of windows on the 20-story building, designed by Herman Carl Baumann, had formed water leaks that were causing steel flange corrosion and associated cracking and spalling. Remedial restoration was urgently needed.

Previous recoating attempts had left more than 90 mils of

nonbreathable coating on the exterior, and dressing with beads of sealant also failed to correct the leaks. Led by consulting engineer JFM Enterprises and façade consultant Wiss, Janney, Elstner Associates (www.wje.com), the contractor Everest Waterproofing & Restoration routed and sealed the cracks with a polyurethane sealant and coated any added reinforcing steel with an epoxy-cement coating. Spall repairs were either hand-applied or formed and poured with polymer-modified repair mortars; galvanic shielding materials were used along with repair cements and non-shrink grout to protect the steel window flanges and select areas of the reinforcing steel near the windows. The methods and materials used allowed the Building Team to preserve Baumann's original design intent, with its ornate columns and arches.

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Holabird & Root employed a high-performance coating for the metal panels on Waubonsee Community College in Plano, Ill. The panels (from Centria) are coated with a premium fluoropolymer (manufactured by Valspar) containing 70% polyvinylidene fluoride (PVDF) proprietary resins.

METAL COATINGS AND PAINTS

The goals for specifying coatings, sealants, paints and sealers for architectural metal are similar to those for masonry systems: extend the building or system lifespan, while achieving the desired aesthetic effect. The specific metal type will determine the most appropriate surface treatments. In every case, you should focus on addressing the potential for corrosion. Oxidation may be caused by naturally occurring conditions of weather and climate, or by galvanic interaction of different reactive metals that come into contact at an architectural joint.

Primers: Fighting flash rusting. In field applications, a primer (or undercoat) should be applied first to provide a preparatory layer for the paint. The primer's most urgent function is to protect against corrosion, but it must also create a lasting bond between the topcoat and the metal substrate, says Wightman & Associates' LaDitka.

Another reason to use a primer coat: the topcoat itself could cause corrosion. According to the Paint Quality Institute (www.paintquality.com), water-based paints and coatings can cause flash rusting, in which the surface of ferrous metal reacts because the coat dries too slowly. This can be prevented by using a nonreactive primer, or by using formulas with rust-inhibiting additives.

According to the PQI, primers for applications in light- and medium-duty environments can use water-based epoxy or acrylic resins for a base. (In heavy-duty environments, a zinc-rich combination of epoxy resin and polyamide hardener should be used.) The water-based epoxy and acrylic primers eliminate corrosion by preventing moisture from reaching the metal substrate; they also contain inhibitive pigments—also called reactive pigments—to pacify the metal via chemical interaction, making it resistant to chloride and similar ions.

Paint: Good availability, reasonable cost. Coating architectural metal with paint is a commonly used surface treatment for metal. Industry experts generally urge specifiers to go with shop- or factory-applied coatings; as noted, in field applications a primer should be applied first.

For coating exposed exterior steel, Wightman & Associates' LaDitka recommends that the primer and first finish coat should be applied in the shop to all exposed surfaces, and to any other surfaces that might come in contact with environmental elements. This technique helps avoid edge rust that can occur at component connection points. The third coat should be field-applied for quality control and color of finish, says LaDitka.

Powder coating: From the shop to your job. The choice of powder coating for metal building materials brings two key benefits: controlled shop application by the manufacturer or fabricator, as well as a resilient, fully cured surface. The coating is applied as a free-flowing, dry powder; it is typically applied using electrostatic equipment and then cured with heat, without need for the solvents that make paint a liquid, according to Georgia Powder Coating, a subcontractor based in Gainesville, Ga., that has prepared panels for the recently opened One World Trade Center in New York City. "The powder may be a thermoplastic or a thermoset polymer," according to Georgia Powder Coating. "It is usually used to create a hard finish that is tougher than conventional paint."

Using sublimation processes, some powder-coat treatments can transfer decorative patterns onto metals and other substrates, such as laminates and medium-density fiberboard, to create durable, photorealistic images on the target materials. The powder-coat surfaces tend to be more durable and resilient than painted surfaces, which powder-coat experts like to call "shells." Polyester resins and other additives may be added to the process to ensure the images or patterns stay sharp and resist wear or degradation.

Powder coating typically takes place in a shop with spray guns operated inside a protective booth under strict environmental controls. The production lines generally produce less hazardous waste than conventional liquid coatings, according to Georgia Powder Coating, and any overspray can be recycled to achieve close to 100% capture of coating materials. Because solvents are generally sources of VOCs, typical powder coatings emit near-zero VOCs, and some coating operations are certified as zero-VOC facilities. Rework and rejected materials are rare: powder coating tends to lead to fewer appearance differences, especially when matching surfaces

that are coated horizontally with those applied vertically.

Anodized aluminum: Durable, corrosion-resistant. According to the Aluminum Anodizers Council (www.anodizing.org), anodizing is an electrochemical process that converts the metal surface into a decorative, durable, corrosion-resistant, anodic oxide finish. Anodizing yields a hard surface that resists corrosion and oxidation. The thickness of the treated surface layer depends on process variables. According to the anodizing company Lorin Industries, anodized aluminum is better suited to paint primers, sealants, and adhesives than untreated (non-anodized) aluminum surfaces.

Dyes can be applied to create colors for anodized aluminum. The use of colored anodizing is an exceptionally lasting and resilient finish type that won't flake or chip. Building materials can be batch anodized or treated in a continuous coil process, which is effective for treating large building components or when visual matching across a number of pieces or large surfaces is required.

WHEN TO THINK TWICE
about using surface treatments

COURTESY KOENIGSBERG ENGINEERING, PC

For the Bank of America/Majestic Theater in Chicago, Koenigsberg Engineering's team was able to custom-specify new terra cotta (left helf) to precisely match the look of 100-year-old detailing.

There are cases where paints, coatings, or other surface treatments are not only unwarranted but may even adversely affect the desired performance or aesthetic. These situations have to be identified early in the planning phase, as they represent a threat to life cycle performance and could result in costly repairs and maintenance.

Tim Weber, BEC, LEED AP BD+C, a Project Manager for architecture firm Cordogan, Clark & Associates, says that he has encountered restoration projects where coatings were disadvantageous. "I prefer not to seal brick masonry mass walls," he says, explaining that the sealer "has a significant impact on the drying potential of the material and assembly." In general, porous materials must not be treated with nonpermeable barriers, membrane, or latex paints.

How the product is applied is important, says Glenn Pellet, AIA, Vice President with Ronald Schmidt & Associates (http://www.rsaaia.com). Brushing and spraying are the most common application methods for commercial and institutional settings, due to their low labor cost and square footage of coverage per gallon. He warns, however, that "spray might be the least expensive way to apply the product, but the paint may not penetrate into voids or bridge all cracks and holes."

Application of some coatings can create color-matching problems that negatively impact desired aesthetics. Richard Koenigsberg, PE, President of Koenigsberg Engineering, cites his firm's work with terra cotta for the exterior of Chicago's Bank of America Theater (formerly The Majestic) as an example of how certain materials demand techniques other than coating.

In the image shown, a new terra cotta feature (on the left) has been matched to one almost 100 years old. To get a match like that requires that the coating be applied in place and fired on, says Koenigsberg, who prefers custom-fabricated terra cotta for this reason. "It's the only way to get a match that works from varying angles, distances, and lighting that will survive the test of time." Matching repair materials can take months of trial and error. He recommends testing on samples—such as broken pieces that have fallen off the original material—to be matched when a coating is absolutely called for.

FACTORY APPLICATION VS. FIELD APPLICATION: WHICH IS RIGHT FOR YOUR JOB?

The choice between applying a surface treatment in the factory versus in the field depends on several factors: the project budget, the anticipated use and wear of the treated surface over its life cycle, and the manufacturer's recommendations and services. But the most important determinant should be the experience of the Building Team members.

Consider as an example a project with a cool roof requirement, for which the designers have determined that a light-colored coating will be used. In this case, the substrate may be a major determinant. According to the U.S. Department of Energy's EERE Building Technologies Program, it may not matter whether the coating is applied in the factory or the field for wood, polymer, or metal shingles. But field application of a cool roof coating for asphalt shingles may void the manufacturer warranty for the shingles.

Cordogan Clark's Weber says his firm prefers factory or shop-applied finishes rather than field application. "Coatings applied in controlled environments typically yield better quality, durability, and appearance to tighter tolerances," he says. Weber also recommends shop-applied coatings for custom millwork orders.

Wightman & Associates' LaDitka generally concurs, with the caveat that some manufacturers offer no finish process or limited color palette. "Factory-applied coatings save labor and simplify construction in the field, with one less trade to coordinate," he says. In cases where factory application is not economical or simply not feasible, field applications for piecework and restoration and refurbishment projects may be the only alternative.

One concern among construction experts is the potential for damage to the coating in shipping or on the construction site, which can ruin the aesthetics and threaten the system's functionality. Sometimes a combination of field and factory applications achieves the best results, says LaDitka. "For premium steel finishing, a three-coat system is preferred, with the primer and first finish coat in the shop, and final finish coat in the field," he says. "It's worth the cost for a satisfied client and for successful product performance."

Because the environment can be difficult to control in a field application, correct surface preparation is extremely important. "Project success comes down to understanding your substrate, and performing proper surface preparation," says Weber. Contractors

must follow the manufacturer's guidelines carefully with regard to surface preparation for sealants and coatings. "Substrates must be clean, sound, dry, and free of frost, oil, and grease," says Koenigsberg. He recommends mechanical cleaning for concrete and other porous substrates, which provides a surface free of contaminants or laitance—an accumulation of fine particles on the surface of fresh concrete due to an overly wet concrete mixture.

Glass and metal should be cleaned with an approved commercial solvent that meet manufacturer specs; the solvent should be wiped clean and allowed to evaporate.

Testing: What location is best? The question of where to perform mockups and testing will arise: In the lab? On the job site? An independent lab provides controlled conditions, theoretically making the results more reliable. But the finished project will not be used in the lab. The project site provides conditions for testing similar to those in which the product or system will have to perform for the duration of its life cycle. Your team will have to weigh the benefits of field-testing versus lab testing, or be prepared to conduct both, if possible.

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COURTESY RONALD SCHMIDT & ASSOCIATES, P.A.

The Hackensack University Medical Center's new John Theurer Cancer Center was designed to minimize the use of products containing toxins and VOCs. Healthcare clients prefer low-VOC and no-VOC coating products but also need to address color selection, maintainability, replacement product, and the ability to repaint over already coated areas.

Testing of surface treatments is performed to ensure proper adhesion and performance and to gain an accurate assessment of the product's life cycle. While the testing should be done under your control or by an independent testing service. The manufacturer's representative can also offer expert advice, particularly at the project site. "Mockups, field adhesion testing, and field coordination meetings provide the opportunity for the coating manufacturer to communicate recommendations and concerns directly to the installer, ensuring a proper installation," says Weber.

In many cases, exhaustive field testing will be the only way to ensure a desired aesthetic; this is especially true in restoration work. At River Plaza in Chicago, Koenigsberg's team applied a coating as part of a patch and crack repair job. Unfortunately, what appeared to match on the vertical face was clearly visible as a repaired spot on the sloped face, where the sunlight was more direct "Color matches are often easy from one angle or a specific distance, but can be impossible to make right from varying angles and distances," he says. Koenigsberg also notes that for some materials and substrates, such as terra cotta, there simply is no cost-effective way to match color with coatings.

COURTESY KOENIGSBERG ENGINEERING, PC

For River Plaza, in Chicago, Koenigsberg Engineering found that the more direct sunlight on the sloped portion of the repaired concrete exposed the repairs more glaringly than was the case on the vertical face.

Communication and job site coordination. According to the National Glass Association, damage to finished, factory-coated building materials like aluminum fenestration typically occurs on the construction site. "These aluminum parts must be well protected and shielded to prevent construction damage," says Tammy Schroder, LEED GA, with the coating and anodizing subcontractor Linetec, in an article for *Glass* magazine. "Installation dents, scratches, masonry splattering and run-off, weld fluxes and spatter, tar roofing, brick and masonry cleaners, and mortar and muratic acid can all cause damage to the installed aluminum."

Coordinating trades and facilitating communication among the various groups in play are critical; otherwise, damage to factory treatments will need to be addressed in the field, which can be quite costly. Even more costly is the damage that may go unnoticed, leading to system failures and costly remediation after construction.

LaDitka says it's good to get the coordination and communication problems ironed out as early as possible. "Questions are often brought to our attention at the pre-bid conference, or when product specifications are submitted," he says. "We'll work with the subcontractors to understand their problems and find the best solutions based on our knowledge and their expertise, as well as the expertise of the installer or worker in the field."

> EDITOR'S NOTE

Additional reading is required for this course. To earn ***1.0 AIA CES HSW learning units****, finish the reading, study the complete article, and take the exam posted at*
www.BDCnetwork.com/WetAppliedCoatings

BETTER AIR, BETTER HEALTH

For Building Teams looking at interior paint and coating options, recent changes to the U.S. Green Building Council's LEED program—specifically, LEED v4—will drive project design decision-making, says Wightman & Associates' Marissa Kovatch, a LEED-accredited designer who has worked on airports, retail prototypes and hospitality venues, among others. "LEED is a significant factor in specifying low-VOC coatings, but any spaces that are occupied—or that soon will be—are also going to get a low-VOC spec requirement in order to minimize odors and disruption to occupants," she says.

The key LEED provisions include a number of restrictions for products that have volatile organic compounds, or VOCs. The key is to minimize exposure to actual emissions—rather than simply compare disclosed VOC content—by using test data based on occupant "exposure scenarios" defined by the California Department of Public Health (CDPH) Standard Method v1.1-2010. (Manufacturers indicate the exposure scenario on their submittals or other documentation.) The units vary, but all must state mass of product applied per area of surface. For paints, total VOCs are measured after 14 days and categorized as 0.5 mg/cubic meter or less; between 0.5 and 5.0 mg/cubic meter; or 5.0 mg/cubic meter or more.

In addition, the credit for paints and coatings is part of a broad Low-Emitting Materials credit, which includes flooring systems and composite wood and agrifiber products as well as paints, coatings, adhesives, and sealants.

For contractors, the new LEED certifications include a number of protections for trade workers and painters applying wet-applied products on site; these must be considered for LEED-rated projects. The main rule is to ensure that coatings and sealants do not have methylene chloride (MeCl) or perchloroethylene (perc), which "are only used in a small number of aerosol adhesive products," according to California Air Resources Board (ARB), but "the three compounds are toxic, and used in numerous other consumer products and industrial processes." ARB and other groups consider these substances, along with trichloroethylene, as probable human carcinogens.

In addition, the coatings and sealants must have constituent materials that fall below what are considered "excessive" levels of VOCs. This requires ensuring that any selected manufacturers divulge VOC content based on testing to the South Coast Air Quality Management District (SCAQMD) Rule 1113 from mid-2011 or the California Air Resources Board's 2007 Suggested Control Measure for Architectural Coatings. The SCAQMD Rule 1168 from 2005 is applicable for any wet adhesives and sealants used on site. (For projects outside the United States, follow these rules or national VOC regulations if they are more stringent.)

As far as which paints and coatings off-gas the most VOCs or work the best, Building Teams are still seeking definitive answers, says Bill LaDitka, AIA, LEED AP, Principal at Wightman & Associates. "We haven't studied this exhaustively, but it seems that oil-based paints and epoxies are most noticeable on the construction site, although even the low-VOC ones can be pretty strong," he says. "It appears the biggest difference is cost. We only started specifying low VOCs about four years ago so there isn't a long track record on durability."

For this reason, many Building Teams say that clients are requesting low-VOC products but at the same time asking about color selection, maintainability, the ability to repaint over already coated areas, and the availability of replacement product, according to Glenn Pellet, AIA, Vice President, Ronald Schmidt & Associates, an architecture firm that specializes in healthcare, higher education, and public buildings. "Low VOCs and no VOCs is where the team should start," he says. "At the same time, our healthcare clients want to know if the surfaces are washable." He notes that most manufacturers have been reformulating their product lines to low-VOC and water-based coatings, which and don't affect the environment during application or afterwards.

COMPLEXITY AND CONTRADICTION

Specifying paints and coatings for high-performance, sustainable, and durable building projects takes a lot of documentation and analysis. For this reason, many Building Teams will start with a basis-of-design specification for a key paint product, for example, and supplement this later on with apples-to-apples documentation, such as environmental product declarations (EPDs) or life cycle assessments (LCAs). "Manufacturer-provided specs are most common," says LaDitka. "We will start with a major manufacturer's products as a basis of design and select those that meet the VOC limits of LEED. When we need to have a more open specification we will use Master Painters Institute standards to establish quality."

According to the Master Painters Institute, the Building Team must "consider their coating system options based on the substrates with the pros and cons for each coating, and information on normal usage." Guide specifications for painting, wall covering, and abrasive blasting are available through MPI, along with approved coating products. In addition, the team should communicate the guide specifications and the requirements for appropriate surface preparation, as well as such miscellaneous information as:

- Dew points
- Wood types
- Paint spread rates
- Concrete block standards
- Gloss/sheen levels
- Wall coverings

For a maintenance repainting situation, MPI has a manual with details on substrate assessments and the way to select a coating system based on degradation determination and the tricky situation of a transition between two disparate coating systems.

The MPI guide specifications help immensely in understanding manufacturer master specifications and their references. So do the Construction Specifications Institute (CSI) MasterFormat documents, which have divisions for indoor and outdoor paints and stains as well as decorative and textured finishes or high-performance coatings; for example, those that resist abrasion, chemicals, and fire or that are textured, elastomeric (viscous and elastic), or intumescent,

meaning they swell when exposed to heat. Every coating type and application will imply specific criteria for the Building Team that must be referenced in the specifications—even before getting to the standards and variables related to sustainable design.

For determining the green contributions of a wet-applied building product, the team can review LCA information from manufacturers to understand performance over the entire product life cycle performance. The team can also review EPDs, the third-party, science-based verification of environmental claims based on an ISO 14025 standardized report on LCA data for applicable product category rules (PCRs). The benefits? "EPDs can be verified by an independent third party," according to NSF International, which writes public health standards and also validates EPDs. "They are also included in LEED v4 in a new criteria for the Materials and Resources Category."

"This is an up-and-coming issue, and LCAs and EPDs help Building Teams to understand the total cost of the product as well as downstream considerations, such as what the real cost is environmentally and at what point the client can expect that the product has served out its functional life," says Ronald Schmidt & Associates' Pellet. "For a client that is very sensitive to sustainable design or very high performance, they might look for these, but it may limit the team's ability to find competitive manufacturers."

Last November, Eco Health Data launched an online database called The EPD Registry (theepdregistry.com) to help project teams quickly determine which manufacturers have EPDs. "Many product manufacturers have begun releasing EPDs to meet the growing desire for product transparency. However, finding those EPDs can be very time consuming," says Eda Clausen, Principal at Eco Health Data. At the same time, only about 400 EPDs were verified and registered within the International EPD System, another service that can be browsed for free EPD downloads (environdec.com/en/EPD-Search).

From VOCs to EPDs, simply documenting the proper products and application techniques for coatings, paints, and sealants is an increasingly time-intensive and paper-heavy process. With these increasing levels of complexity—and the potential that some products may not work as well as desired—some Building Teams report that they look for ways to avoid coatings entirely, or that they be factory applied.

Engineer Richard Koenigsberg says it helps to select a single manufacturer for advice and "warrantable solutions" to as many of the project challenges as possible faced by the Building Team. One of the benefits is that the manufacturer will have extensive field experience on suitable substrates and substrate preparation for a needed coating—or, put another way, which coatings will best work for a given situation.

green paints and coatings
EDUCATION MODULE

*Pass this exam and earn **1.0 AIA CES HSW learning units**. You must go to **www.BDCnetwork.com/WetAppliedCoatings** to take the exam.*

1. True or false: Nanoparticles added to building sealants and coatings can help prevent staining and graffiti, reduce ultraviolet damage, and improve flowability and application of the finishes.
A. True B. False

2. The LEED provisions that restrict coatings products on the basis of volatile organic compounds, or VOCs, require that the Building Team only:
A. Disclose VOC contents
B. Review VOC test data from the California Department of Public Health
C. Select products that will minimize exposure to VOC emissions
D. None of the above

3. To meet LEED certification requirements, coatings and sealants must have constituent materials that fall below what are considered "excessive" levels of VOCs based on testing to:
A. South Coast Air Quality Management District (SCAQMD) Rule 1113 only.
B. Either SCAQMD's Rule 1113 or the California Air Resources Board's 2007 Suggested Control Measure for Architectural Coatings
C. California Air Resources Board's 2007 Suggested Control Measure for Architectural Coatings only
D. None of the above.

4. Which of the following can be used to write an open specification for a building coating?
A. Environmental product declarations, or EPDs
B. Life cycle assessments, or LCAs
C. Manufacturer product defect warranties, or PDWs
D. Standards of the Master Painters Institute, or MPI

5. For a maintenance repainting situation, the Master Painters Institute (MPI) has a full manual with details on substrate assessments and the way to select a coating system based on such factors as:
A. Required color appearance
B. Degradation determination
C. Cost per square foot
D. None of the above

6. Which of the following is NOT a feature of environmental product declarations, or EPDs?
A. They are science-based environmental claims.
B. They can be verified by a third party.
C. They are the same as life cycle assessments, according to the ISO.
D. They are included in LEED v4 certification language.

7. Painting precast concrete is more challenging than painting stucco, because precast concrete:
A. Has a much higher density
B. Has a much higher porosity
C. Has fewer contaminants from release agents used for formwork
D. None of the above

8. In reinforced concrete, the concrete itself can be an agent in corroding the embedded steel:
A. Only on cold or coastal climates
B. Because the concrete provides an electrolyte
C. Because chemical de-icers provide chloride ions
D. Only when acidity boosts the alkaline nature of the concrete

9. According to experts in brick systems, it is best to avoid the use of nonpermeable coatings on …
A. All clay brick that is intended to breathe
B. Brick cavity walls only
C. Brick veneers only
D. Clay pavers and historic brick only

10. What powder-coat treatments can be used to transfer decorative patterns onto metals as well as other substrates?
A. Thermoplastic finish
B. Laitance
C. Three-coat field application
D. Sublimation process