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The Voice of SSPC: The Society for Protective Coatings

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FEATURES

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DEPARTMENTS

FROM THE OFFICES OF SSPC The Society For Protective Coatings

ALSO THIS ISSUE

STAFF

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Useful Tips for Spraying High-Solids Coatings

Spraying thick, 100-percent-solids coatings on industrial steel structures presents a series of challenges that differ in variety and degree from your standard paint application issues. These coatings have very high viscosities and very short pot lives, and therefore must be mixed at precise ratios of parts A and B, and because they are solvent-free, must be heated during spray out to ensure proper flow of the coating for correct and uniform application.

Photo courtesy of SSPC.

Before beginning a project such as a tank lining installation requiring spray application of high-solids, thick-film coatings such as 100-percent-solids amine epoxy, it is essential to have a field-tested work process, as well as qualified applicators and equipment operators. If your company has done this kind of work before, you should check with the project manager, crew, foreman and superintendent that previously did the work to go over lessons learned from past projects and discuss how these spray jobs might differ from other less demanding applications.

It's important, too, to be aware of the ambient and physical conditions at the job site. As always, very cold or very warm temperatures will have an effect on the operation. The configuration of the structure being painted, as well as the presence of other trades in the work area, can impact how and where you set up your spray pump and spray lines. One benefit of using 100-percent-solids epoxies, especially when working around other trades, is that they are relatively odorless compared to solvent-borne materials. If this type of work is new to your firm, consult with the technical services representative for the spray pump equipment you are going to use and the coating supplier's technical services representative in developing your work plan.

If your painter has little or no experience with the process of spraying 100-percent-solids coatings, training is always recommended, and SSPC offers the Marine Plural Component Program (MPCAC, C14) and Plural Component Application for Polyureas and High Solid Coatings (PLURAL) courses for this type of coating work. The applicator should also perform test sprays before beginning work to become familiar with the equipment being used.

The following considerations should always be top-of-mind in order to achieve a successful coating application.

Equipment: Spraying these coating materials requires use of spray equipment that has enough thrust to push the thick material through the lines. The exact amount of thrust needed is calculated on a per-job basis and will be dependent on the viscosity of the coating material, so make sure that the spray equipment and the coatings being used are compatible with each other. Because of short pot lives, plural-component equipment is the best choice to control the mixing of the two components, and to keep the material heated for good flow during spraying. High-powered airless spray equipment such as a 50:1 pump or higher is usually required for effective spray pressure. Pumps in the 70:1 or higher range will be required for spraying farther away from the pump with longer spray lines and hoses.

Gravity feeding of the coating is preferred to suction feeding in order to obtain good flow, as it doesn't require energy production to feed the material through the lines. Most plural-component units gravity feed the coating through hoppers attached to the unit.

It's important to refer to the coating material manufacturer's product data sheet (PDS) to ensure use of the correct filter and spray gun. Consult the PDS and discuss the application with the coating supplier's representative to determine which filter, spray tip and spray gun to use for best results. When spraying filled coatings (such as glass-flake), it may be best to remove the filter to avoid clogging.

Coating Temperature: Make sure coating temperature is carefully controlled to ensure good flow and prevent the coating from setting too quickly. Most plural-component units have built-in heating units for spraying high-solids coatings. However, it's critical not to set the temperature too high. The heating temperature required will depend on the material being applied, the geographic region and environmental conditions, as well as the coating material supplier's recommendations. As always, consult the coating material PDS for exact heating instructions.

Material Lines: Again, refer to the PDS to ensure that the paint lines are the correct size and are rated to handle the fluid pressure in the line when the coating is flowing from the pump to the nozzle. This is both a productivity and safety issue, as inadequately rated hoses can break apart and expel harmful coating materials at high pressures. Hoses should always be checked before spraying to make sure there are no leaks or worn areas.

Mixing: Before spraying, the coating must be properly mixed to ensure the correct ratio of the resin and activator, parts A and B. Check the PDS and the coating manufacturer's recommendations for mixing. Otherwise, the coating will not perform as expected, even if all other steps are followed properly.

It is also important to use a high-shear mixing blade and to mix at the proper speed to avoid entrapping air in the coating. Note, too, that parts A and B are each mixed separately then placed in the plural-component unit where the two parts are mixed together at the mix manifold.

Cleaning the Lines: Use the correct solvent recommended by the coating manufacturer when cleaning (flushing) your spray lines after completing a spray session. It is critical to make sure lines are properly flushed to ensure all the material is cleaned out of the lines to avoid clogging and off-ratio spraying during the next spray session. Check the pump manual on proper procedures for flushing paint lines after spraying. Some flushing may be required during the spray operation to keep lines clear. Some plural-component pumps may have a separate solvent pump to flush the lines from the mix manifold forward to the spray gun for any production stoppage.

Troubleshooting: When problems arise, a lot can be determined by the spray pattern being produced. For instance, a fingering pattern may be an indication of low processing pressure and an incorrect gun setup (i.e., wrong tip size) or low processing heat. If the spray pattern is deformed, it is an indication of a dirty spray tip or a mix chamber obstruction. If spraying pulsates, the viscosity of the material may be too thick or the spray gun output is exceeding the spray pump output.

Other common problems related to equipment functionality are: insufficient spray pressure; the system speeds up or runs erratically; the pressure gage not balancing; and the heated hoses not heating properly. These problems are often related to the equipment electronic board, the primary heaters or the hose heating systems. In these cases, have the equipment manufacturer's representative examine the equipment.

For questions or for more information about spraying heavy materials, contact Heather Stiner, manager of technical services, SSPC, at stiner@sspc.org or 412-281-2331, ext. 2224.

COMING UP

SSPC COURSES

Course information available at sspc.org

July 6–7	C10 Floor Ctg, Gibsonia, Pa.
July 6–8	Plural Comp App, Portland, Ore.
July 7	Estimating, Newington, N.H.
July 8	Selection of Ctgs, Newington, N.H.
July 11–12	C7 Abrasive Blast, Zephyrhills, Fla.
July 11–15	C2 Plan/Spec, Ventura, Calif.
July 11–15	NBPI NAVSEA Basic Pt Insp, Annapolis Jct., Md.
July 11–16	BCI Bridge Ctg Insp, Portland, Ore.
July 13–14	C12 Airless Spray, Zephyrhills, Fla.
July 16	PCS Prot Ctgs Spclst, Ventura, Calif.
July 18–19	CCB Conc Ctg Basics, Houston
July 18–20	Develop Ctg Spec, Seattle
July 18–23	CCI Conc Ctg Insp, Houston
July 21–22	Inspection Plan/Doc, Seattle
July 24	CCI Supplement, Houson
July 25–Aug. 6	PCI Prot Ctgs Insp, Batam, Indonesia

CONFERENCES AND MEETINGS

July 13–14	Latin American Ctgs Show 2016, Mexico City, coatings-group.com
July 17–20	ASCE Pipelines Conf 2016, Kansas City, Mo., pipelinesconference.org

July Webinar Helps Contractors "Hold" the Blast

The next installment of the 2016 SSPC/*JPCL* Webinar Education Series, available in July, will offer tips to help painters stick to the specified timetable between abrasive blasting and primer coat application.

"Holding the Blast: Challenges and Impacts on Project Scheduling," will be presented by Doug Reardon of KTA-Tator, Inc., on Wednesday, July 27, from 11:00 a.m. to 12:00 noon, EDT. This webinar is sponsored by CHLOR*RID International, Inc.

Many specifications contain stipulations stating that the surface area that has been abrasive blast-cleaned be primed within four hours, eight hours or "within the same work shift." The reason for this requirement is the fear that the surface will deteriorate if left "open" to the environment. Contaminants like the presence of soluble salts on the surface, and conditions including high humidity and a dew point temperature at or below the surface temperature can accelerate rust-back. There are methods to "hold" the blast that can have a positive impact on preserving surface quality as well as the project schedule. This webinar will describe some of the challenges associated with holding the blast and the advantages and limitations of potential solutions for consideration.

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Webinar Education Series


Doug Reardon

Doug Reardon is the steel group operations manager for KTA-Tator, Inc., where he has been employed for over 25 years. In this position, Reardon serves as a senior project manager for structural steel fabrication projects for various transportation clients nationwide, in addition to assisting the field inspection staff with technical report reviews, scheduling, and project updates/status reports. He is an AWS Certified Welding Inspector and RT Film Interpreter; a NACE-certified Coating Inspector Level 3 (Peer Review); and a Level II inspector in accordance with ASTM D4537. Prior to his current assignment, he was a KTA project management specialist for 13 years, providing construction supervision and paint/insulation services to Bayer Corporation at its New Martinsville, West Virginia plant. Reardon serves as a principal instructor for a variety of KTA-offered training seminars, and he has successfully completed numerous industry-related courses.

Registration, CEU Credits

This program is part of the SSPC/*JPCL* Webinar Education Series, which provides continuing education for SSPC re-certifications and technology updates on important topics. SSPC is an accredited training provider for the Florida Board of Professional Engineers (FBPE), and Professional Engineers in Florida may submit SSPC Webinar Continuing Education Units to the board. To do so, applicants must download the FBPE CEU form and pass the webinar exam, which costs $25. Register for this online presentation at paintsquare.com/webinars.

SSPC Announces 2016 Board Election Results

SSPC is pleased to announce the results of its 2016 Board of Governors election. In total, four positions were up for election, including two open positions and two incumbent positions.

In the Other Product Supplier demographic, an open position, the winning candidate was Ross Boyd, CEO and founder, TruQC LLC. Boyd co-founded TruQC, a cloud-based, paperless coatings documentation application, in 2011. TruQC's software was designed to be compliant with SSPC-QP, -QN and -QS certifications. Boyd has worked with hundreds of contractors, manufacturers and inspectors to learn their processes, documentation needs and requirements.


Ross Boyd

In the Facility Owner demographic, another open position, the winning candidate was Mana H. Al-Mansour, engineering specialist, Saudi Aramco. For almost 20 years, Al-Mansour has worked exclusively in the field of protective coatings. His responsibilities with the Consulting Services Department (CSD) of Saudi Aramco Central Engineering cover development of engineering standards, providing technical support to capital programs and operations departments, introducing new technologies and new talent development.


Mana H. Al-Mansour

Two incumbents were also up for re-election, including Joseph Walker of Elcometer, Inc. in the Other Product Supplier demographic, and Joyce Wright of

SSPC Awards 10 College Scholarships

Since 2011, SSPC has offered up to 10 $2,500 scholarships to college students who are beginning or continuing their educations at institutions of higher learning in the United States or Canada.

SSPC is pleased to announce the following recipients of scholarships for the 2016–2017 school year.

- Ruvi Chitemere
  North Dakota State University
- Mason Kline
  The University of Pittsburgh
- Junren Lin
  North Dakota State University
- Feby Mathew
  The University of Akron
- Emanuel Mehas
  St. Petersburg College
- Payton Nixon
  Belmont University
- Madhura Pade
  North Dakota State University
- Alison Rohly
  North Dakota State University
- Samantha Silbert
  North Dakota State University
- Christopher Znosko
  The University of Akron

In order to be considered for the scholarship, each candidate must be a high school senior planning to enroll full-time or a student already enrolled full-time in an accredited institution of higher learning that has a three- or four-year curriculum. He or she must also be a member of SSPC in good standing, or a child or grandchild of an SSPC member in good standing.

Awarded scholarship funds shall be applied to the direct costs of the student's education courses. To coordinate the effort, SSPC will work with the institution's financial aid office to ensure proper use of the funds. In addition to the scholarship, each student is awarded a one-year membership in SSPC.

SSPC wishes to congratulate each of the students on this accomplishment.

Joseph Walker *Joyce Wright*

Huntington Ingalls Industries–Newport News Shipbuilding in the Facility Owner demographic. Both candidates were re-elected by the membership. Walker will begin his second term as a Board member, while Wright will begin her first full term, after having been appointed to complete the remaining term of Gail Warner, who retired in 2015.

Terms for the new Board members will begin on July 1, 2016.

Hempel Strives for Sustainable Coatings

Danish coatings supplier Hempel is working to develop sustainable antifouling coatings through a grant program sponsored by the European Economic Area (EEA), the company said in a statement on May 3.

The Copenhagen-based maker of coatings for the decorative, protective, marine, container and yacht markets said the project will enable the company to increase the use of renewable raw materials in its antifouling formulations.

The EEA Grants program represents the contribution of Iceland, Liechtenstein and Norway in reducing economic and social disparities and in strengthening bilateral relations with 16 EU countries in Central and Southern Europe and the Baltics. Funding is channeled through 150 programs, which must reflect environmental considerations, including sustainable development.

Hempel notes that marine shipping is the most environmentally friendly way to transport goods, when compared to airfreight, rail or road transportation. Still, the maritime industry accounts for about 4 percent of the world's manmade CO_2 emissions, it says.

The use of advanced antifouling hull coatings, which can improve a vessel's hydrodynamics and reduce fuel consumption, is one way to cut emissions, according to the company. Because large vessels burn fuel by the megaton, even a small reduction in fuel consumption can mean significantly lower emissions, the company says.

Hempel claims its antifouling coatings can reduce a vessel's fuel consumption and associated emissions by between 4 and 8 percent per year. A sustainable production process — that is, using renewable raw materials in its formulations — would make its antifouling coatings even more environmentally friendly, the company adds. Josep Palasi, strategic technology director of R&D at Hempel, said that, over the past 30 years, the company has been developing coatings that lower the environmental impact of its customers' operations and also "drive the industry forward."

"Improving the environmental performance of our own formulations is a natural extension of this work, and we hope that the industry embraces the concept," he said.

The project is being run by the company's Antifouling Centre of Excellence in Polinya, Spain.

THE Buzz on PaintSquare.com

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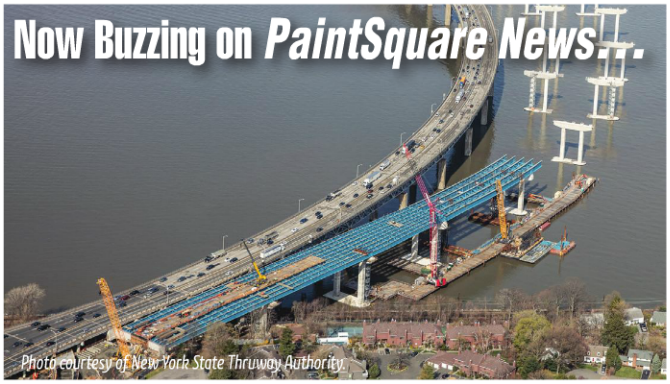

Photo courtesy of New York State Thruway Authority.

New NY Bridge Builders Tout Safety Record (May 5)

New York's Tappan Zee Bridge replacement project, billed as the largest bridge and highway infrastructure project in North America, is also reported to be one of the safest construction ventures in the country.

According to Tappan Zee Constructors, the design-build consortium responsible for the new bridge, the total recordable incident rate is 0.63 percent per 100 employees — which makes it more than five times lower than the national average of 3.5 percent for a construction project of its size, *The Journal News* reported May 2.

The nearly $4 billion New NY Bridge will be a 3.1-mile twin span cable-stayed bridge with angled main span towers. It is the single largest bridge construction project in New York's history, according to the TZC website, and because it crosses the widest part of the Hudson River, it is also one of the most challenging.

Still, with more than 1,200 workers putting in 6 million man hours over two shifts, seven days a week largely over the river surface, the accident rate remains low. "From day one, from 2013 to present — 21 incidents," Project Safety Manager Daryl Lloyd told the local ABC affiliate. "To have ... basically one incident every three months is amazing, considering the type of work we do out there and the challenges we are facing," he added.

TZC President Terry Towle credits the organization's "strong safety culture" for keeping its injury rate so low. "Our industry is one of the most dangerous in America," Towle told the area paper, adding that his father and brother had been seriously injured on construction jobs. "One-fifth of workplace fatalities happen in the construction industry."

TZC, however, indicates it places an emphasis on safety initiatives, keeping upper management involved in the program. It has conducted more than 1,000 safety training seminars in addition to providing on-site medical care and drug and alcohol screenings.

If there is anything a worker is unaware of when coming on-site, training is available to ensure everyone's safety, a site manager told ABC. Moreover, "On this job, if they are asked to do anything unsafe, if they see anything unsafe, they are allowed to stop the work, and get it fixed," Towle said.

PSN TOP 10 (as of May 31)

1. Google's New Coating Catches Pedestrians
2. Oops: New Bridge Is Too Low
3. Worker Sues Shipyard for Lead Exposure
4. Tunnel Wall Collapse Swallows Roadway
5. Seattle Borer Drills Past Viaduct
6. Mudslide Envelops Hydro Construction Site
7. New NY Bridge Builders Tout Safety Record
8. Quest Buy Buoys Valspar in Q2
9. Turbine Breaks Records
10. FTC Reviews Acquisition

WHAT'S GOT US TALKING

"Worker Sues Shipyard for Lead Exposure" (May 31)

Alleging exposure to toxic levels of lead and other toxins while refurbishing a freighter, a shipyard worker has filed a lawsuit against the facility where work was performed, as well as the vessel's owner. The suit, which asks for $75,000 in damages, faults the defendants for failing to take steps to warn of the presence of toxins aboard the ship and then, once workers began to fall ill, concealing the presence of critically high levels of lead.

Douglas Steitz: "Forty-eight years old performing all these multiple tasks? Has this man ever heard of a respirator?"

Ron Cros: "It's up to the company to ensure that all necessary safety equipment for all trades is provided to their employees. Now, if an employee chooses not to use it, well, that is another story!"

David Johnson: "Safety first. Employers have a responsibility to protect their employees — even contract employees. This ship was built in 1959 and is still plying the seas 57 years later. The ship owner and contracting companies are required to investigate in the event of a complaint."

Car F.: "The employer owns and controls ALL activities in the workplace, including adherence by the workers to safety rules and standards. Training, supervision, enforcement and discipline are paramount conditions to have a safe and profitable business; anything else is fiction."

On Stripe Coating

WHY DO WE STILL NEED TO STRIPE COAT GIVEN THE ARRAY OF HIGH-SOLIDS, EDGE-RETENTIVE COATINGS CURRENTLY ON THE MARKET?

Per Gabrielsson
Freelance Consultations and Inspections
Physical forces will move the coating from the steel edge. Stripe coating is one of the most essential steps in the coating process and should always be applied by round brushes. If rolled, the stripe coat will only be "slashed" onto the surface and will not be worked in around manual welds.

Gerald Holton Jr.
Specialty Polymer Coatings USA Inc.
"Edge-retentive" is a loose term. It all depends upon the coating being applied and method of application. When applying via spray, a stripe coat is a warm fuzzy that provides you with added confidence that there will be less likelihood of a holiday. With hand-applied products, based upon the surface to be coated, the stripe coat can be applied prior to or as a final coat upon completion of application. I agree that use of a roller may not provide the mils required.

Alfredo Claussen
Instituto Mexicano del Petróleo
In addition to the physical force (resulting from the surface tension of the still liquid paint, prior to drying) already mentioned by Per Gabrielsson, there is another physical phenomenon that compounds the situation. This phenomenon tends to simultaneously "pull" the coating away, not only from the edges, but from internal angles in inside corners and crevices, as well as from weld seams. It is derived from the residual stresses created when the coating resin matrix suffers an inevitable shrinking due to chemical reactions in polymer coatings, creating stressed regions where the coating failure is more prevalent than on flat surfaces. As the grinding of the steel beam edges and rounding or smoothing of weld edges is a lengthy and thus costly process, the usual (and undoubtedly) next best thing to do is stripe-coating, regardless of any edge-retentive coating vendor claims.

Post your problems and solutions at www.paintsquare.com/psf

Warren Brand
Chicago Coatings Group
From a practical perspective (I was a contractor for about 25 years prior to becoming a consultant), it's a very fast, proportionately low-cost task which is critical for any long-term paint or coating application, particularly given the difficulty in accurately measuring the DFT on edges. There's simply no compelling reason not to do it.

Mariana Huhulea
SeaQuest Marine
Project Management Ltd.
When it comes to edge protection against corrosion, I would say stripe coating is a must. Application by roller is not the best solution; however, it is better than to not do it at all. On weld seams, however, I would be more cautious as stripe coating may increase the DFT and cause cracking, especially for modified epoxies. Thus, prior to project commencement, all relevant parties must agree on where and how many stripe coats should be applied, depending on the chosen coating materials.

THE MYSTERY OF THE DISAPPEARING TOPCOAT

BY PETER BOCK
CUI SPECIALIST, CONSULTANT

Several thousand miles of natural gas pipelines crisscross the United States, bringing gas from production areas to end users who may be gas-fired electrical generating plants, petrochemical plants that use gas both as fuel and feedstock, or residential and commercial consumers who use gas to cook, heat spaces and produce hot water.

Mainline gas pipelines are usually underground, but every twenty or thirty miles along the pipeline, there is a compressor station with a gaggle of metering stations, vents, diverters, pig launchers, pig traps and other equipment, all above-ground and clearly visible. Compressor stations are usually in rural areas following the pipeline, but their ownership is clearly identified. Metering stations, vents and pig launchers may be in the middle of farmers' fields or grazing land, frequently separated from the growing crops or grazing animals by only a chain-link fence and an access roadway.

In the 1960s and 1970s, gas pipeline companies kept large maintenance crews, and painting of above-ground equipment was normally done by that crew. Each spring, the crew went out to all of their above-ground facilities for painting. Surface preparation was usually limited to a hand scraper or wire brush cleaning, followed by a generous dab of alkyd or long oil red lead primer. Then the entire above-ground unit received a brush or roller coat of hydrocarbon aluminum paint, whether it needed it or not.

In the 1980s, a combination of environmental considerations increased regulation of pipeline operations with the availability of better, "cleaner," longer-lasting coating systems, and the reduction of in-house pipeline company maintenance staffs moved maintenance painting of above-ground gas pipeline facilities to professional contractors.

Today's gas pipeline operating environment is very tightly regulated, with frequent oversight by outside authorities who may or may not be coatings experts. Similarly, public relations, community acceptance and perception of the pipeline company as a "good neighbor" have become significant and valuable objectives for the pipeline's owner. Pipeline companies want their above-ground equipment to shine like a new pickup truck, fresh off the dealer's showroom floor.

Paint projects and the associated surface preparation must also be clean, environmentally friendly, and with little or no effect on the neighbors. As part of its "good neighbor" policy, the gas pipeline company will go to great lengths to assure neighbors and passers-by that its maintenance painting project won't harm the people, crops or grazing animals within the immediate vicinity.

Most paint projects are now fully tented, with 100-percent recovery and disposal of spent blasting abrasive. Wherever possible, low-VOC, zero-VOC or waterborne coatings are used to minimize the environmental impact of a maintenance painting project.

Long-term performance and cost effectiveness of a coating system for above-ground facilities and equipment is now balanced with the requirements of "clean" application and that glossy "new pickup truck" appearance, which assures anyone looking at the metering station or pig trap that the pipeline company really is a good neighbor, meets all the regulatory requirements and isn't harming the environment, either locally in the adjoining fields or overall in its system-wide operation.

Major industrial coating manufacturers work closely with gas pipeline companies to supply their latest coating systems, incorporating the longest-lasting, cleanest and best appearing products suitable for field application. These products and systems usually have years of laboratory and outdoor testing behind them before they are released for use. The manufacturer also works closely with the pipeline company's selected contractors to assure proper application of the new-technology coating systems when they are first used in the field. Nothing should go wrong, but then there are so many things that cannot or could not be tested beforehand, which brings us to the case in question.

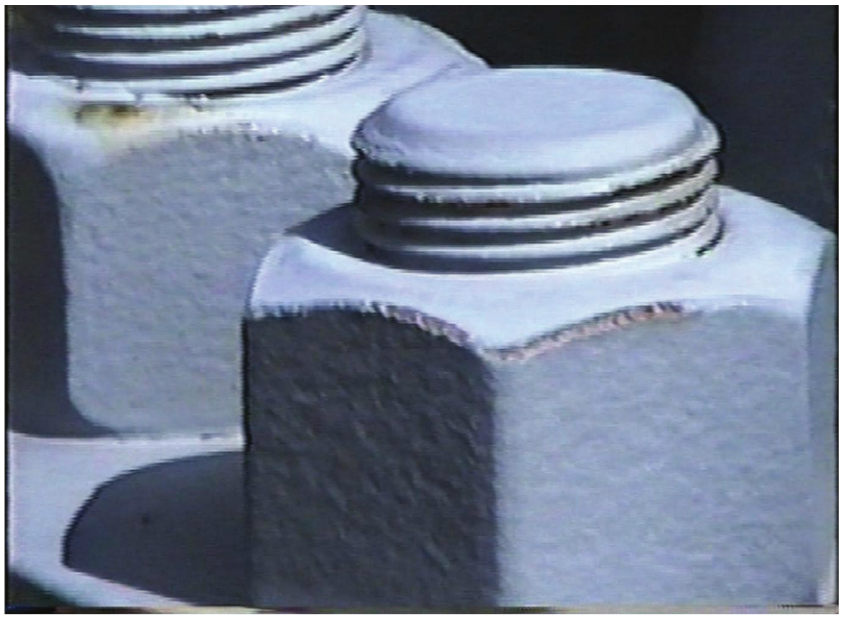

Fig. 1: A six-month inspection revealed a thin line of gray topcoat missing with the black midcoat showing through. Photo courtesy of the author.

A large southeastern U.S. onshore gas pipeline company switched its specified maintenance coating system from epoxy and urethane to a three-coat, near-zero-VOC waterborne system. This waterborne system had nearly five years of laboratory and environmental testing, including successful use on a number of offshore production platforms in the Gulf of Mexico.

The gas pipeline company decided to introduce the new coating system at a central Mississippi compressor station and the first project in early spring was a series of metering facilities, valve groups and pig traps in the middle of soybean fields surrounding the compressor station. Surface preparation was to SSPC-SP 10/NACE No. 2, "Near White Blast Cleaning," the coating system was applied by an experienced contractor and the coating manufacturer provided 100-percent, on-site technical service. The project surface preparation and application went well.

A six-month inspection in late fall of the same year revealed that the gray topcoat was missing and the black midcoat showed through in a very thin line on a number of protruding sharp edges — bolt heads, nuts, flange edges and the edges of beams and support structures (Fig. 1). The exposed stripe of black midcoat was typically 2/16 inch wide and nearly continuous. No other problems were observed.

Surface preparation and application had been flawless. The same batch of materials used on later projects at the same compressor station on similar equipment did not exhibit this problem. Edge retention issues with the topcoat were suspected but could not be duplicated in the paint manufacturer's lab and were not encountered in the field with the same batches of material. The gas pipeline company agreed to continue using the waterborne system and to continue monitoring the problem to see whether it would get any worse.

A thorough survey of the problem project early the following spring and just after a year in service showed no change from the six-month inspection. The inspectors were at a loss when a compressor station operator who farmed soybeans on his days off came forward.

"You know, the grasshoppers loved your new paint last year," he said. "The grasshoppers swarmed about two weeks after the contractor finished that first set of meters out in the middle of the fields."

"Grasshoppers?" asked the confused paint technician.

The grasshoppers are a favored nuisance, explained the compressor operator. They swarm every spring and eat most of the leaves off the soybean plants, forcing the plants to put more energy into growing the beans larger and creating a better harvest for the owner of the field. They also try to eat anything else they can get their little mandibles around.

Field testing on sample panels and observation of newly painted pipeline equipment over almost a year involved chasing fields where grasshoppers were present and putting out sample panels for them to chew or not chew confirmed this: the grasshoppers would chew off a narrow strip of gray waterborne topcoat on protruding sharp edges (only on protruding sharp edges and in a strip only as wide as their mandibles could reach), as long as the topcoat was less than three weeks old.

The grasshoppers were not interested in the older gray topcoat or the black midcoat, even if it was used as a topcoat, and they could not get their mandibles around anything other than projecting sharp edges. This explained the narrow black (midcoat) pin-stripe effect visible on the metering station.

The pipeline company's solutions were simple, though unusual for a maintenance coating specification: either schedule coating projects surrounded by soybean fields to allow full cure of the gray waterborne topcoat before the annual grasshopper swarm, or schedule coating projects surrounded by soybean fields only after the annual grasshopper swarm.

And never underestimate Mother Nature.

AT LAST, THE SILICA STANDARD. WHAT NOW?

©iStockphoto.com/Mark Kostich

BY ALISON B. KAELIN, CQA, ABKAELIN, LLC

Those of you that know me can appreciate that I was one of the few people in the universe who jumped up and clapped my hands when I heard that the OSHA 29 CFR 1926.1153, "Respirable Crystalline Silica in Construction" standard had been issued in April 2016. I first wrote about silica in 2008 for *JPCL* and have discussed the hazards of silica in nearly every SSPC C-3, C-5 and health hazards class I've taught in the past 30 years. This standard is highly controversial, heavily lobbied for and against, and according to OSHA will save over 600 lives and prevent more than 900 new cases of silicosis each year. OSHA estimates about 2.3 million workers are exposed to respirable crystalline silica in their workplaces, primarily in construction.

Silica is associated with nearly every facet of the coatings industry; as a substrate (a component of concrete and Portland cement), as an abrasive or abrasive component, and as a component in many coating systems.

It has long been known that significant silica exposures can occur during blast-cleaning with abrasives that contain silica. The U.S. Department of Labor first highlighted the hazards of respirable crystalline silica in the 1930s after a wave of worker deaths. OSHA set standards to limit worker exposure in 1971, the same year that OSHA was created. However, the standard is 40 years out-of-date and does not adequately protect workers from silica-related diseases.

In 1979, NIOSH recommended that use of silica sand or other material containing greater than 1.0-percent crystalline silica (quartz) as a media for abrasive blasting be prohibited. OSHA first listed it as a priority for rulemaking in 1994. In 1998, NIOSH issued a report entitled, "Evaluation of Substitute Materials for Silica Sand in Abrasive Blasting." OSHA failed to issue any comprehensive regulations for silica, but issued a National Emphasis Program (NEP) for Crystalline Silica in 2008. The NEP established policies and procedures for inspection and changed how the permissible exposure limit (PEL) for silica was calculated. The NEP specifically targeted employer classifications such as painting and paper hanging; general contractors; and highway, bridge, and tunnel construction; and it explicitly identified abrasive blast-cleaning as a high-exposure activity. The proposed rule was issued in 2013.

Health effects of crystalline silica include silicosis (an incurable and often fatal lung disease), lung cancer, chronic obstructive pulmonary disorder (COPD) and kidney disease. Current health effects data indicate that lung cancer and kidney disease occur at airborne exposures much lower than the previous PEL.

The new standard establishes a PEL of 50 micrograms of silica per-cubic-meter of air at an eight-hour time weighted average (TWA). The action level is 25 $\mu g/m^3$ at an eight-hour TWA. The employer must implement engineering controls and work practices followed by respiratory protection (similarly to how exposures to lead and other toxic metals are managed).

Alternately, for common construction tasks it establishes dust control and respiratory protection requirements so that

employers know exactly what they need to do to limit worker exposure to silica (Table 1). Tasks listed include the use of handheld, impact and rotary hammer drills; power chipping tools and grinders; and walk-behind grinders.

For all work activities listed in Table 1 or where an employee's exposure is above 25 µg/m³ as an eight hour TWA, the employer must do the following.

- Establish and implement a written exposure-control plan that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur.
- Designate a competent person.
- Use housekeeping practices that reduce worker exposure to silica such as HEPA vacuums and wet methods.
- Offer medical exams — including chest X-rays and pulmonary function tests (PFTs) — every three years for workers who wear a respirator for 30 or more days per year.
- Train workers on work operations that result in silica exposure and ways to limit exposure.
- Keep records of workers' silica exposure and medical exams.

For abrasive blast-cleaning, OSHA concluded that abrasive blasting was not suited to the Table 1 approach because employers have several options of control measures based on their particular application, such as substitution of a low-silica abrasive, use of wet-blasting, or process or containment enclosures and engineering controls. For abrasive blasting using containment and engineering controls, the standard also invokes the Ventilation standard for construction (29 CFR 1926.57) and the Respiratory Protection standard (29 CFR 1910.134). The preamble to the final rule states that the following additional regulations are invoked for abrasive blast-cleaning of silica.

TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS WHEN WORKING WITH MATERIALS CONTAINING CRYSTALLINE SILICA

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(x) Jackhammers and handheld power chipping tools	Use tool with water delivery system that supplies a continous stream or spray of water at the point of impact. – When used outdoors. – When used indoors or in an enclosed area. OR Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. – When used outdoors. – When used indoors or in an enclosed area.	None APF 10 None APF 10	APF 10 APF 10 APF 10 APF 10
(xii) Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. OR Use grinder equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism. – When used outdoors. – When used indoors or in an enclosed area.	None None None	None None APF 10
(xiii) Walk-behind milling machines and floor grinders	Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. OR Use machine equipped with dust collection system recommended by the manufacturer. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None None	None None

Source: OSHA

CONTAINMENT SYSTEMS 29 CFR 1926.57(F)(3)

- Containment systems must be ventilated to create a continuous inward flow of air at all openings during the blasting. (This is consistent with SSPC-Guide 6 Class 1A-3A containment systems.)
- Air inlets and access openings must be baffled or arranged to minimize the escape of abrasive or dust. (Class 1A-3A controlled air make-up.)
- The rate of dust collection (or air velocity) must be sufficient to provide prompt clearance of the dust-laden air within the containment after the blasting stops. (Class 1A-2A.)
- Before the containment system is opened, abrasive blasting must stop and the dust collector must run for a sufficient period of time to remove the dusty air within the containment system.

• Safety glass protected by screening is to be used in observation windows where hard, deep-cutting abrasives are used.
• Slit abrasive-resistant baffles must be installed, inspected and replaced in multiple sets at all air inlets where dust might escape.
• Doors are required to be flanged and tight when closed. (Class 1A-2A resealable doorway.)
• Doors are to be operable from both inside and outside. (Class 1A-2A resealable doorway.)

DUST COLLECTORS AND/OR ENGINEERING CONTROLS 29 CFR 1926.57(F)(4)

• The construction, installation, inspection and maintenance of engineering controls and dust collection systems are to meet American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960 and ANSI Z33.1-1961.
• Immediately repair dust leaks.
• Monitor the static pressure drop at the exhaust ducts leading from the dust collector following installation and periodically thereafter. Implement cleaning if pressure drop occurs.
• Use an abrasive separator recycling systems for reusable abrasives.
• Use dust collection equipment and set up to allow removal of dust without contaminating other work areas.

The standard has two appendices addressing worker exposure monitoring and medical surveillance. Employers are required to comply with all obligations of the standard by June 23, 2017, except methods of sample analysis which goes into effect June 23, 2018.

The General Industry and Maritime standards are similar to the aforementioned, but include requirements for regulated areas. Employers covered by the General Industry and Maritime standard have until June 23, 2018 to comply with most requirements; additional time is provided to offer medical exams to some workers and for hydraulic fracturing

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employers to install dust controls to meet the new exposure limit.

Immediately upon passage, the rule was contested by multiple construction and labor industry groups.

THIS MEANS YOU

We are funny in our industry — we deal with dangerous conditions and materials, risk acute and chronic health effects and face life-or-death situations on a daily or ongoing basis. I can't tell you how many industrial painters have told me they didn't need respiratory protection. Stan Liang and I noted in our 2008 *JPCL* article about silica ("New OSHA Program Targets Silica, Other Blast Cleaning Hazards") that "we tend to only think about ventilation, cleanup and other controls when lead and other toxic metals are involved." I've watched well-trained workers and professionals alike, myself included, skip on using the hand wash, pull off the respirator to talk or wear our regular clothing underneath ineffective protective clothing. In many cases we've become "immune" to the hazards that we face every day.

Yesterday, one of my friends called me. He's about my age, is a contractor and has been in the surface preparation and coatings business a little longer than I have. He's faithfully hired me throughout the years to train his workers in OSHA requirements, to consult on lead and other hazardous coatings projects. He prayed with me when my father was diagnosed with lung cancer. We've been to many conferences together. The most recent training I did for his company was on silica hazards right after release of the proposed rule. He's just been diagnosed with chronic silicosis and had part of his lung removed and biopsied. The results are pending.

Whether you are in the office or in the field, the message is clear. It's not about the silica standard and meeting minimum federal requirements. It's about health and safety. No one should get sick doing their job. Workers' lives matter. Our lives matter. Let's not wait to put into place and use the controls and work practices that we know we need to reduce exposures to silica and other known hazards like lead and solvents. The Silica standard came too late to protect my friend or many others that will likely suffer health effects from the hazards in our industry. See OSHA's websites on silica for more information: www.osha.gov/silica and www.osha.gov/dsg/topics/silicacrystalline.

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Alison B. Kaelin, CQA, has more than 30 years of public health, environmental, transportation and construction management experience in the coatings industry. She is the owner of ABKaelin, LLC, a provider of OSHA training, quality assurance, auditing, consulting, and related services to the protective coatings, construction, fabrication, and nuclear industries. Kaelin is a certified quality auditor and a NACE-certified Coating Inspector. She was a co-recipient of the 2016 Coatings Education Award, a co-recipient of the inaugural SSPC 2014 Women in Coatings Award, a 2012 *JPCL* Top Thinker, a 2012 *JPCL* Editor's Award Winner and an SSPC Technical Achievement Award winner in 2005. Kaelin is also a *JPCL* contributing editor.

LADDER SAFETY: PROTECTING WORKERS FROM A COMPLEX HAZARD

BY STANFORD LIANG, CIH, CSP, CET
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Fall hazards are one of the most common causes of accidents, injuries and death in the workplace and many of these falls occur from ladders. According to the Bureau of Labor Statistics, in 2009, 20 percent of fatal falls in all workplaces were from ladders. OSHA estimates that each year there are 24,882 ladder injuries, 36 of those resulting in fatalities and nearly half of the total annual injuries serious enough to result in lost work time. Falls from ladders are primarily caused by faulty ladders, improper ladder setup or incorrect ladder use.

Environmental conditions in which ladders are used also contribute to accidents, including electrocutions from contacting power lines while setting up ladders or falling after being overcome by hazardous atmospheres in confined spaces.

Controlling fall hazards from ladders is not only important to worker health and safety but also when it comes to minimizing the risk of OSHA citations. In 2014, OSHA Safety and Health Regulations for Construction: Stairways and Ladders (29 CFR 1926.1053) was the seventh-most-cited OSHA standard.

Despite ladder hazards and OSHA regulatory requirements being well-known, every year, ladder usage continues to result in accidents, injuries, fatalities and citations. In addition to regulatory penalties, associated costs include increased worker compensation expense, lost productivity and loss of business opportunities as many facility owners who use third-party contractor screening services will not allow contractors to bid on projects if their OSHA recordable or worker compensation experience modification rate exceeds that of their peers.

One major reason that ladder use continues to result in workplace hazards is that controlling ladder use requires a comprehensive safety program that addresses the complexity and underlying causes of ladder hazards, as well as the OSHA regulatory requirements.

The complexity of controlling ladder fall hazards arises from the variety of ladders in use, their individual uses, and the work-site conditions under which they're used. Ladders can be portable, such as extension and step ladders, or fixed. Other fall-control considerations include how and where workers mount and dismount ladders and ensuring that workers follow the correct procedures for setup and use.

While safety issues with ladders may be well-known, employers and supervisors must be aware of OSHA regulatory requirements. The OSHA standard regulates fixed and portable ladders differently. Also, ladders are regulated under two sets of OSHA Standards: General Industry Standards (29 CFR 1910) and Construction Industry Standards (29 CFR 126). This article summarizes the requirements most commonly applicable to industrial painting projects, describes ladder types, and most importantly, discusses the steps that employers must consider in order to control fall hazards.

PORTABLE LADDERS

Before use, workers should be in the habit of inspecting their ladders for visible defects that may render them unsafe, such as missing rungs. Wooden ladders cannot

be painted with an opaque coating that hides defects. Rungs must not have any substance on them, such as oil or grease that can cause slip hazards. A formal ladder inspection program should be in place. Defective ladders should be tagged "OUT OF SERVICE" or "DO NOT USE" and disposed of.

A fundamental element of a ladder safety program involves ensuring that ladders are used in accordance with the manufacturer's intent and limitations. For example, the loading limit of the ladder must not be exceeded. When using a step ladder, the metal spreader must be locked in the open position. Use of a ladder as part of a makeshift scaffold must be prohibited.

Working from a ladder to perform tasks that involve leaning away from the ladder in order to reach a work area is another common cause of falls. Rather than working from a ladder, alternatives such as scaffolds and aerial lifts should be considered. If it is absolutely necessary to work from a ladder, then the use of personal fall arrest equipment (for example, a full body harness connected to an anchorage via a shock-absorbing lanyard or retractable lifeline) should be considered. Fall arrest equipment is discussed in more detail later in this article.

Workers must be trained in safe climbing practices and supervisors must ensure that those practices are followed. Examples of safe climbing practices in a ladder safety program include the following.

- Portable ladders must be used at an angle that is at a 4-to-1 ratio (run to rise). That is, for every 4 feet the ladder goes up, it must go 1 foot horizontally.
- Ladders are to be used on stable surfaces, unless secured, to prevent accidental displacement.
- Ladders must be provided with slip resistant feet or secured if used on slippery surfaces.
- Ladders must not be shifted, moved or extended while in use.
- Workers must not stand on the top step of the ladder.
- The cross bracing on step ladders cannot be used for climbing except in the case of ladders designed for climbing on both sides.
- When climbing, users must face the ladder and maintain three points of contact. In other words, both hands must be free to grasp the ladder rungs. Workers cannot hand-carry any load or objects that can prevent the worker from maintaining three points of contact while climbing, which necessitates planning a safe means of transporting materials to an elevated work area accessed by a ladder, such as a material hoist.

Fall hazards at ladder landings must also be controlled. Minimum OSHA requirements include the following.

- Extending side rails of portable ladders 3 feet above the landing.
- Providing a grab rail where extension of the ladder above the landing is not possible.
- Keeping the area around the landing as an elevated work surface clear of any debris that could be a trip or fall hazard.

Landings for ladders used to access elevated work surfaces should be evaluated to determine that compliance with the minimum OSHA requirements is feasible and whether or not workers will be protected from exposure to fall hazards. If meeting the minimum OSHA requirements will still expose a worker to potential fall hazards, then additional measures to control hazards must be considered. For example, if portable ladders are used to access an elevated bridge road deck and workers must climb over a guard rail, extending the ladder or providing a grab rail may not protect workers from a fall hazard if they lose their grip or slip during the brief period of time as they are stepping on or over the guard rail. In this case, additional measures to control fall hazards such as use of personal fall arrest equipment or alternate means of access to the work area (such as aerial lifts) should be considered.

To control electrocution hazards, a minimum distance of 10 feet must be maintained. However, to ensure that workers do not approach power lines, it is considered good practice to maintain a 35-foot approach distance. Power lines can sway under heavy winds and by arcing, electric energy can jump a gap between a power line and a ladder. Ladders used in the vicinity of energized power lines must be made of a non-conductive material such as wood or fiberglass to control electrocution hazards from accidental power line contact while raising the ladder. Mark metal ladders with tags or stickers that say "CAUTION-DO NOT USE NEAR ELECTRICAL EQUIPMENT." However, the best way to control electrical hazards is to de-energize the transmission lines, if possible.

FIXED LADDERS

Fixed ladders available on a job site must be evaluated for fall hazards before use. If a fixed ladder has a total length of climb equal to or exceeding 24 feet, it must have a ladder-climbing safety device, a self-retracting lifeline system, or a cage or well. If the ladder itself is less than 24 feet in length, but the climber is exposed to a fall hazard exceeding 24 feet, fall protection must also be provided. Where ladder-climbing safety devices are used (for example grab rails), they must meet the following requirements.

- They must be capable of withstanding the 18-inch drop of a 500-pound weight.
- They must permit the employee using the device to ascend or descend without having to continually hold, push or pull any part of the device, leaving his or her hands free to climb.
- They must activate within 2 feet after a fall occurs.
- The connection between the grab rail and harness cannot exceed 9 inches in length. Typically, the connection method is an auto-lock carabiner attaching the front D-ring on the harness to the ladder-climbing safety device.

Where cages are used, rest platforms must be provided at 50-foot intervals. Rest platforms are necessary because a common cause of falls is exhaustion. If no rest platform is available, personal fall arrest

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equipment or a ladder-climbing safety device must be used.

FALL ARREST EQUIPMENT

If personal fall arrest equipment is used in conjunction with fixed or portable ladders, it is critical that it be used correctly to prevent a hazard. For example, personal fall arrest equipment should never be connected to the rung of a ladder. Ladder rungs are not intended to provide an anchorage to control an arrested fall. Using ladder rungs to connect the snap hooks of personal fall arrest equipment is a common error on many job sites.

Fall protection that is correctly matched to potential hazards should be selected and must be used correctly and inspected before use. Personal fall arrest equipment consisting of a full body harness connected to an anchorage with a 6-foot shock absorbing lanyard requires 18.5 feet of clearance beneath the anchor point. At a minimum, personal fall protection usage must comply with 29 CFR 1926 Subpart M (Construction Industry Fall Protection Standard). To ensure that fall protection equipment will protect workers, its use must also comply with the manufacturer's recommendations.

APPLICATION OF OSHA REGULATIONS

OSHA Standard 29 CFR 1910.12 defines construction work as "… work for construction, alteration, and/or repair, including painting and decorating." In this article we focus on ladder safety as regulated under 29 CFR 1926 Subpart X (Stairways and Ladders) but be aware that OSHA may classify industrial painting as "routine maintenance" and therefore regulate it under 29 CFR 1910 (General Industry). This might be applicable, for instance, when OSHA seeks to apply the most stringent standards. An example of routine maintenance would be minor touch-up painting of plant guardrails.

If you are in doubt, you should review both sets of standards and apply whichever standard is more stringent. In most cases, the Construction Industry Standard will regulate ladder hazards more comprehensively.

LADDER SAFETY PROGRAM ELEMENTS

As with other aspects of job-site safety, OSHA sets the minimum standards for a ladder safety program. OSHA Standard 29 CFR 1926.20 (General Safety and Health Provisions) includes general safety program requirements for construction employers. These requirements also apply to a ladder safety program. Under this standard, every construction site must have a competent person who conducts frequent and regular inspections.

Training is another minimum requirement of OSHA 29 CFR 1926 Subpart X and requires that a ladder training program must include initial and refresher training as necessary and cover the following topics.

- The nature of fall hazards.
- The correct procedure for erecting, maintaining and disassembling fall protection.
- The proper construction, use, care and placement of equipment.
- The maximum intended load-carrying capacities.
- The requirements of applicable OSHA standards.

Training must be conducted by the competent person and must enable employees to recognize hazards and the steps to take to minimize them. This means that the competent person must evaluate the training program for effectiveness. Site inspections or observations revealing unsafe acts and conditions relative to ladders would indicate the need for refresher training to reinforce safe work practices. The competent person should also ensure that other aspects of the safety program are carried out, such as ladder inspections.

It is important to remember that OSHA compliance is an employer's minimum regulatory obligation. Solely focusing on OSHA compliance is not likely to result in preventing ladder accidents. First and foremost, a safety program only succeeds to the degree that management and supervision make it a priority. This means that beyond simply saying "safety is our priority," employers must take steps to fully integrate safety into the day-to-day activities of the workplace. Beyond conducting training, safety must be a part of the process of planning how a job is done.

One useful tool is job safety analysis that identifies the steps in a task, the hazards of each step and how to mitigate them. For example, if accessing an

elevated work area is one of the steps in a task, the job safety analysis (form) would identify a hazard such as contact with an overhead electrical line, and how to control that hazard, such as using an electrically non-conductive ladder and maintaining a minimum clearance of 10 feet.

Finally, while OSHA does not mandate documentation of a ladder safety program, it will not be possible to demonstrate the effectiveness of the program without documentation. Examples of documentation that should be kept on file include the following.

- Training materials and attendance sheets.
- Competent person site hazard inspections.
- Ladder inspections.

It should be noted that this article is not a comprehensive account of all aspects of ladder safety. Examples of additional information on specific regulatory requirements and safe work practices can be found in the following resources.

- 29 CFR 1926.62 Subpart M: Fall Protection (www.osha.gov).
- 29 CFR 1926.62 Subpart X: Ladders and Stairways (www.osha.gov).
- OSHA Informational Booklet 3124: *Stairways and Ladders.*
- OSHA Informational Booklet 3071: *Job Hazard Analysis.*
- *Painting and Decorating Contractors of America Supervisors Safety Manual.*

Ladder hazards in a construction workplace are not static and can change over time. An ongoing job-site hazard inspection program is needed to detect new hazards that may have been unanticipated at the start of a project. Such new hazards may necessitate additional training or updates to safety program tools such as a job safety analysis.

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