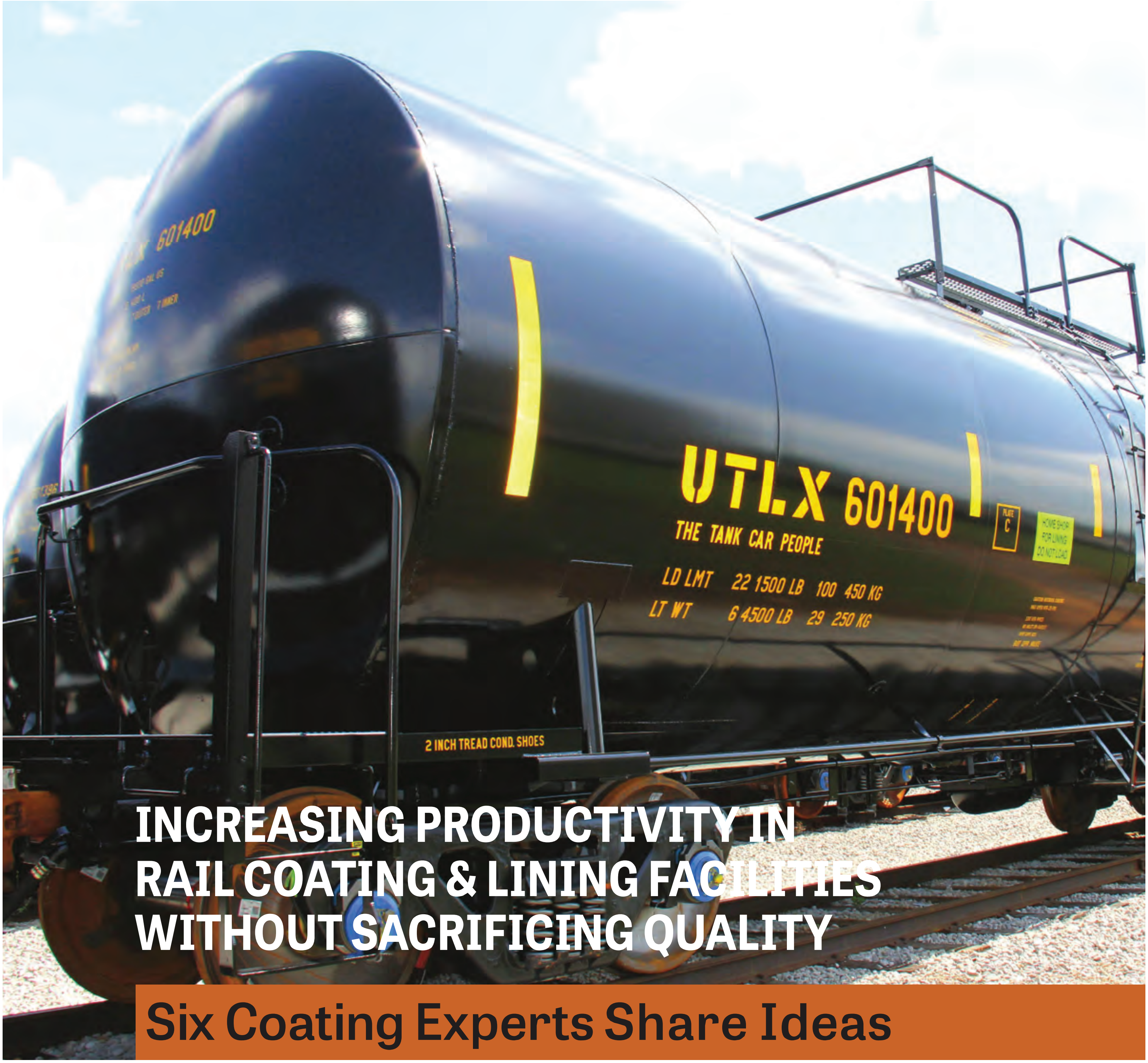


INCREASING PRODUCTIVITY IN RAIL COATING & LINING FACILITIES WITHOUT SACRIFICING QUALITY

Six Coating Experts Share Ideas

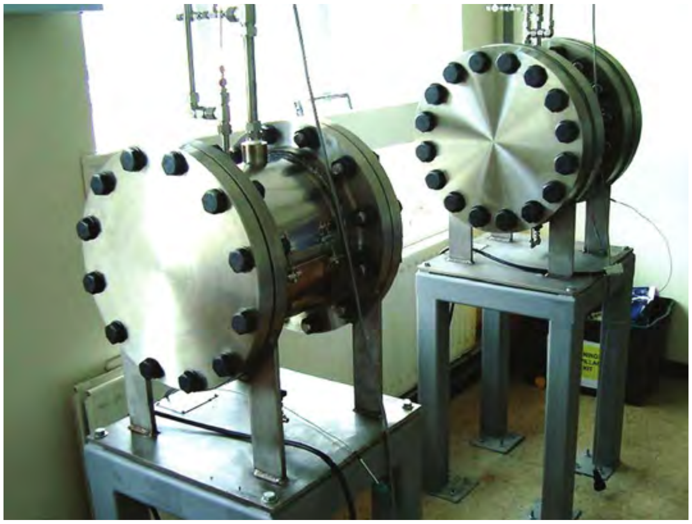
Photo courtesy of Union Tank Car Company/UTLX.

Adapted by Jim Molnar, UTLX, from the 2015 Mechanical Association Railway Technical Services Annual Conference, Protective Coatings Committee Session

Each year, the Mechanical Association of Railcar Technical Services Protective Coatings Committee assembles railcar coating experts to discuss the latest issues affecting the industry. This article is an aggregation of those discussions.

INNOVATIVE COATINGS AND LININGS TECHNOLOGY FOR RAILCARS

According to Vijay Datta of International Paint, formulating and testing for robustness and improved application characteristics leads to increased life and utility of rail tank car coatings in fuels and other services. He puts the menace of corrosion into financial perspective by noting that the loss of steel in railcars, as well as other steel structures in North America, adds up to a cost of corrosion 50 times greater than the total cost associated with the region's natural disasters. Datta points out that the composition of some newer tank car ladings, such as crude oil and biodiesel, is non-homogeneous and variable, requiring the interior coatings used to



(Above, left and right): A battery of tests, including autoclave and atlas cell, screen interior coating candidates for rigorous exposures. Photos courtesy of International Paint.

package them to have a wider spectrum of chemical resistance than the usual, narrowly focused, exposure-designed coatings typically used in purpose-built cars. Long-running industry trends toward fewer coats, higher film build and high solids have bred innovations such as novolac vinyl esters and polycyclamine-cured novolac epoxies, the latter of which show high temperature resistance, tolerance to compromised surfaces and suitability for multiple environments, making them appropriate for less-predictable environments.

Datta notes that polycyclamine-cured novolac epoxies in particular can be formulated with agreeable application characteristics such as a one-hour pot life, a workable viscosity unheated and a six-hour dry to a hard, walkable surface at ambient temperatures. Extensive lab testing, including NACE TM0185, "Evaluation of Internal Plastic Coating" autoclave testing at elevated temperatures and pressures with a 3-percent salt solution, provided confidence for a shipper to agree to a "one-year-and-counting" trial tank car application in shale oil service, which routinely sees 180 F.

Datta also envisions railcar exterior coatings transitioning to longer life, more weather-resistant and cleanable paint types (such as polyaspartics and polysiloxanes) once total lifecycle costs are taken into account.

ENHANCED THROUGHPUT WITH WATER-BASED COATINGS

Some users of water-based materials report marked improvements in user-friendliness and drying characteristics, in addition to better weathering, versus the solvent-based products they have switched away from, relates **Wayne Kurcz of Williams-Hayward Protective Coatings**. The use of water-based paints on railcars surged in the 1970s and has remained significant since then. Of the over 500,000 rail units that have been painted with water-based coatings over that time, 95 percent have been single-coat, single-component systems, in many cases supplanting or even overcoating a two-coat solvent-based system, saving shop time and labor and reducing or entirely eliminating VOC emissions.

Although water-based paints depend on water evaporation to dry, Kurcz finds that users report that dry-to-handle times meet or exceed their expectations, especially as compared with

The majority of railroad freight cars are painted with water-based coatings.

European railcar paint applicators have embraced the use of water-based materials.

Major railroads and railcar lessors have observed water-based paint lasting in excess of 20 years, with little or no chalking or color change. Photos courtesy of Williams-Hayward Protective Coatings.

Curing setup including vacuum film, vacuum blanket, heat blanket, rubber patch, rubber inlay and original rubber (left).

Cutaway of cured patch (center).

Control screen (right).

Photos courtesy of PolyCorp Ltd.

oil-based alkyd materials. Recently, he says, railcar applicators in Europe have especially embraced the "green" nature of these typically acrylic-oriented materials. Also, major railroads and railcar lessors have observed, after switching to water, paint lives exceeding 20 years, with little or no chalking or color change.

UPDATE ON RUBBER LINING REPAIR TECHNOLOGY

Existing rubber linings used in tank cars carrying highly-corrosive ladings such as hydrochloric and phosphoric acids are most often repair-patched with a rubber material that mimics, but does not exactly duplicate, the properties of the original due to a different curing mechanism. New technology offers a way to use the "original" rubber material for such repairs, raising confidence in their efficacy and longevity. The rate of any chemical reaction, including vulcanization (the curing of rubber) can be increased by raising the temperature and pressure at which it is occurring. **Lester Eng of Polycorp** explains that by employing a resistance heating blanket and putting a vacuum over a rubber repair patch configuration to create a pressure differential, a curing environment that closely approximates how the lining was originally cured can be created, allowing a vulcanized rubber patch to be made.

Chemical cure, the current patching standard in which curing is effected by topically applying a sulfur-containing or other type of liquid activator which penetrates a specially formulated repair material, requires multiple applications of the curing liquid to achieve a good cure, and the penetration depth of the activator can only be estimated. The process can only be sped up by heating or steaming the entire repair area, an option not always available. By contrast, vacuum-aided vulcanization can be completed in as little as three hours using portable equipment focused directly on the area of concern. A digital controller with recipe selection automates and records the process. The blanket heating also serves to feather and weld down the beveled edges of the repair patch. As this approach continues to develop, Eng and his colleagues expect that this further-engineered, precision-controlled patching method will in many cases replace the traditional chemical cure.

(Above, left and right): Corrosion in an unlined crude oil tank car. Photos courtesy of The Sherwin-Williams Company.

CLEANING UNLINED CRUDE OIL TANK CARS IN PREPARATION FOR LINING

James Kirkpatrick of Sherwin-Williams says that knowing the steps necessary for cleaning and preparing a possibly contaminated and corroded surface for a coated service will enable shops to process cars more efficiently. As an example, he lays out the process of getting a used crude oil tank car ready for coating.

First, one must ensure that all personnel are trained in every aspect of each project-specific confined space safety plan, including the rescue plan and each person's role. Confined spaces should be managed as defined in

OSHA's confined space standard and be monitored for hazardous atmospheres. A written confined space rescue plan and written permit system should be established, implemented and reviewed annually.

Appropriate, properly operating and calibrated (when necessary) safety equipment for air monitoring, ventilation and emergency retrieval, including special winches for workers, must be on hand. There must be communication with the attendant as necessary to enable monitoring of entrant status and alerting of entrants when evacuation is needed.

All liquid residues must be removed from the car interior using the proper grounding and containment procedures. Gas and oxygen readings inside the tank must be measured. A chemical injector is used to apply a hydrogen scavenger cleaner, which removes crude residue. Salt contamination in the cleaned tank should be measured by testing for chlorides. Chloride contamination greater than 8 µg per square centimeter should be treated.

A black light will reveal certain hydrocarbon contamination. Pressure washing with an organic bonding chemical will aid in the removal of chlorides, sulfates and surface-reacted salts.

Check the corrosion for depth of pitting and the density of corrosion. Notwithstanding any tank steel repairs to be made, plan your coating selection and application based on the amount and type of corrosion observed.

It may be redundant to state, but Kirkpatrick emphasizes that proper ventilation and curing of a high-DFT lining system is essential, as well as holiday inspection to assure effective coverage. Finally, repair and touch-up procedures should be agreed upon in the pre-job conference.

IMPROVING SHOP EFFICIENCY WITH ENCAPSULATED MEDIA BLASTING

Ed Zaharias of SpongeJet maintains that new automation allows coating stripping and substrate cleaning with minimal rigging and enhanced contaminant removal.

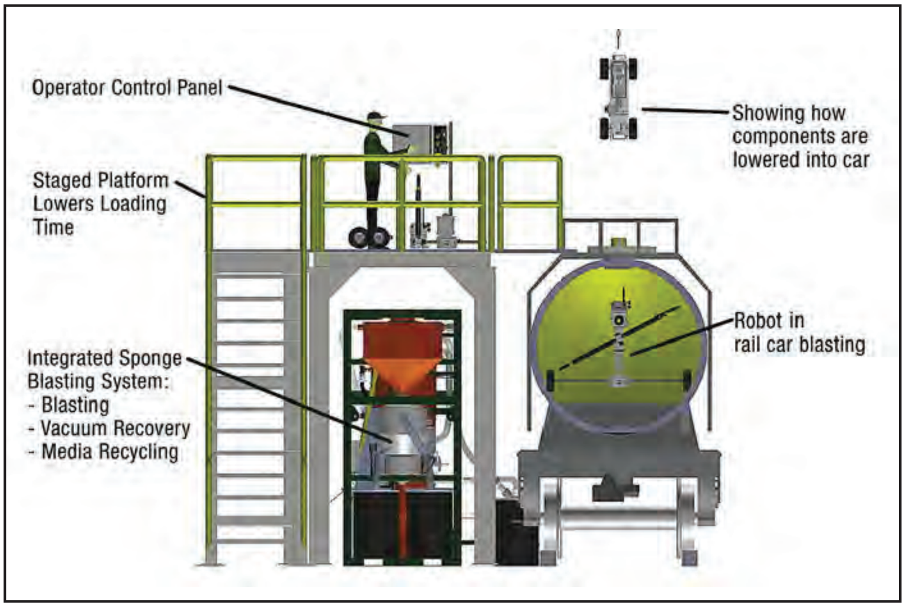
He reminds us again that surface prep issues are responsible for at least 75 percent of coating failures, and that substrate cleaning methods must maintain or restore the necessary profile for coating adhesion. Encapsulated media blasting coupled with an automated blast unit that can be assembled inside the car in 17 minutes can allow coating removal to be completed in as little as one shift's time. Even rubber lining can be stripped by this method.

Zaharias foresees that improvements to the encapsulated media blasting process can lead to increased adoption in the rail industry due to the multiple flexibilities it contributes to shop throughput.

IMPROVING SHOP EFFICIENCY WITH ONE-COAT SYSTEMS

Judicious selection of one-coat interior coating systems for replacement and/

Close-up of an encapsulated media unit. Photo courtesy of Sponge-Jet, Inc.



A schematic of a robotic encapsulated media blasting system. Photo courtesy of Sponge-Jet, Inc.

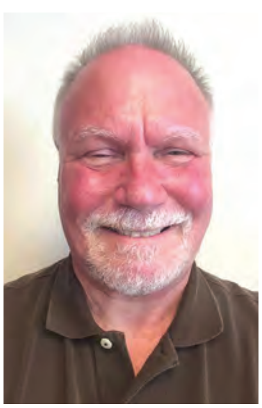
or repair can decrease a shop's throughput burden and an end user's costs, according to **Jody Chisholm of Hempel Coatings**. With larger numbers of railroad tank cars coming through shops for various projects and programs, car owners, lessees and shop management have to revisit what needs to be done while cars are in the shop and how quickly it can be accomplished. That includes looking at the use of one-coat and low- or no-bake interior coating systems as substitutes for two- or more coat and higher bake systems. (A no-bake coating simply means one that cures adequately at ambient shop temperatures due to the nature of its cross-linking reaction.)

Releasing railcars back into service is impacted on the front end by facility backlog and, once in shop, by the speed of processing. Eliminating a coat can subtract one-to-two days of shop dwell time for a tank car. Using a coating with a shorter (lower temperature) bake period can cut another day or two. The commensurate economies can then be passed on to the end user.

Chisholm notes that although high-bake coating technology may provide the most chemical versatility, it does so at a loss of throughput efficiency. There are many low- or no-bake and single-coat systems available that can withstand a wide range of chemical exposures. Of course, the shipper must check with his or her coating supplier to ensure compatibility.

She also points out that the enhanced reactivity of no-bake coatings may mean a shorter pot life and may require application using plural-component equipment. Still, some creative thinking with regard to coating selection can collectively save time and money for all stakeholders in the coating process.

Jim Molnar is the manager of coatings research and development for Union Tank Car Company and chairman of the Mechanical Association of Railcar Technical Services (MARTS) Protective Coatings Committee. The Committee strives to highlight technology and trends of potential interest and benefit



to the railcar coatings and linings community while avoiding commercial endorsement of specific products or services. Molnar has a Bachelor of Science degree in chemical engineering from the Illinois Institute of Technology, is a NACE Level-3 Coating Inspector and was a Featured Coatings Specialist in *JPCL* in 2004.

Editor's note: This article is adapted from presentations made at the MARTS Annual Conference 2015 Protective Coatings Committee sessions in Minneapolis, Minn.*

Mechanical Association Railway Technical Services, a rail industry trade group.* ***JPCL*