White Paper

Safety considerations for application of specialty high-temperature coatings to hot surfaces

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Background

KTA-Tator, Inc. was retained by PPG Industries Ltd., to address occupational safety and health issues associated with the use of specialty coating systems specifically designed for direct application to hot surfaces for preventing corrosion-under-insulation and corrosion in atmospheric (non-insulated) service environments. While specialty high-temperature coatings have reportedly been applied directly to hot surfaces safely and successfully for many years, several factors must be considered. This white paper addresses key safety and health precautions that should be considered.

Special note

Worker safety should be addressed when working on any project involving application of coatings to both ambient temperature and hot surfaces. The employer and the employer's Environmental, Health and Safety staff have responsibility for all aspects of worker safety. Any project involving surface preparation and coating of both ambient temperature and hot surfaces should be properly planned and executed by competent, experienced personnel with approval of, and supervision by, safety representatives for the contractor and facility owner.

Introduction

Managers of petrochemical, refining, power, offshore, petrochemical, pulp and paper, and other facilities with extensive hot processes and piping systems are frequently challenged with performing all the necessary coatings maintenance work only during periods of outages. Outages are required so that process equipment can be properly maintained and repaired including cleaning of pipelines and vessels, maintenance and replacement of pumps, motors and valves, maintenance coating operations, and other work that can only be accomplished when the operations are shut down. When coatings work has to get done on areas where elevated temperatures are involved, many think that the facility has to be shut down. This may not be the case. A question frequently posed by facility managers is, "Can I do maintenance painting work while the plant is operating?" As described below, the answer is, "Yes you can, but there are safety and health issues that must be considered."

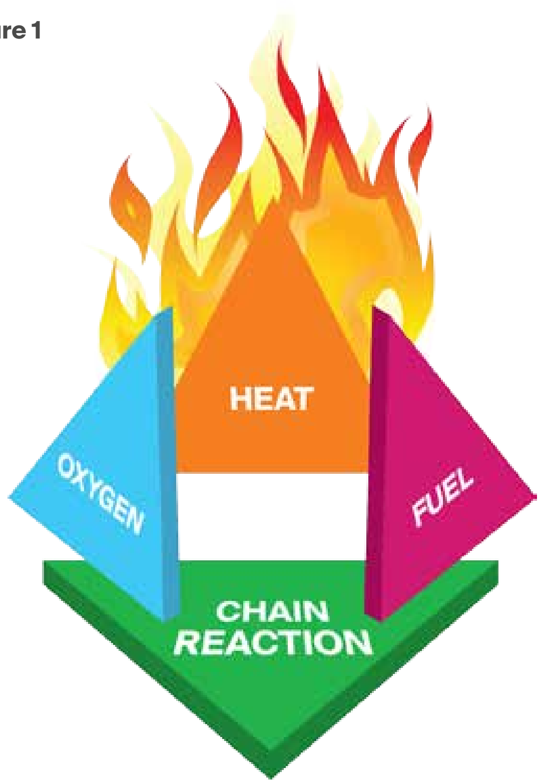
Safety and health considerations

There is a range of safety and health hazards that must be considered on every industrial maintenance painting project, whether the coating material is being applied to hot steel or not. Some of these include proper material handling and storage, fall protection, control of fire and explosion hazards, and exposure to noise, heavy metals, solvents and other health risks. These risks must be properly evaluated and controlled on every industrial maintenance painting project, regardless of when or where the work is performed. While present on any job, when applying specialty coatings to hot surfaces, some safety and health issues should receive additional consideration.

Fire safety

As illustrated in Figure 1, fuel, oxygen, a source of ignition and a chemical chain of reaction must all combine in order for a fire to occur.

Figure 1



The elements of the fire 'tetrahedron' that we can control during coating application are fuel and source of ignition. That is, displacing oxygen in the work area with an inert gas such as nitrogen or disrupting the complex chemical reaction of a fire with a halide suppression system are simply not practical fire prevention strategies during maintenance painting.

The fuel element of the fire tetrahedron is provided by flammable solvents and/or combustible materials in the coating system. A commonly recognized definition of flammable and combustible liquids in the United States is found in the National Fire Protection Association's (NFPA) 30, Flammable and Combustible Liquids Code:

- Flammable Liquid – Any liquid having a closed-cup flash point below 37.8°C (100°F) and having vapor pressure not exceeding 40 psia (276 kPA) at 37.8°C (100°F).
- Combustible Liquid – Any liquid with a flash point at or above 37.8°C (100°F), but below 93°C (200°F).

The internationally recognized Globally Harmonized System of Classification and Labeling of Chemicals (GHS) uses a slightly different definition. Under the GHS system, both flammable and combustible liquids under NFPA terms are considered flammable; i.e., GHS defines a flammable liquid as having a flash point of not more than 93°C (200°F). Substances or mixtures of this hazard class (flammable) are assigned to one of four hazard categories on the basis of the flash point and boiling point:

Table 1: GHS definition of flammable liquids

Category	Criteria
1	Flash point < 23°C (73°F) and initial boiling point ≤ 35°C (95°F)
2	Flash point < 23°C (73°F) and initial boiling point > 35°C (95°F)
3	Flash point ≥ 23°C (73°F) and ≤ 60°C (140°F)
4	Flash point ≥ 60°C (140°F) and ≤ 93°C (200°F)

Note that in the United States, the Federal Occupational Safety and Health Administration (OSHA) modified the existing Hazard Communication standard, including adopting these hazard categories and selected other aspects of the GHS (Federal Register - March 26, 2012). The first portions of the revised standard were enforceable from December 1, 2013, while full implementation was required by June 1, 2016.

Flammable and combustible liquids in many coatings (i.e., solvents) can vaporize and form flammable mixtures in the air, especially when atomized (e.g., during spray application) or heated. The degree of hazard depends on the following:

1. The auto ignition temperature (AIT): the AIT of the coating material is the single most important issue when applying coatings to hot operating equipment. AIT is defined (by the National Safety Council publication Accident Prevention Manual For Business and Industry: Engineering & Technology) as "...the minimum temperature at which a flammable gas-air or vapor-air mixture will ignite from its own heat source or contact with a heated surface without the presence of an open spark or flame." As will be described in greater detail below, the coating must have an AIT greater than that of the hot surface on which it will be applied.

2. The flash point of the liquid. The concept of flash point as defined by NFPA 30 is "...the minimum temperature of a liquid at which sufficient vapor is given off to form an ignitable mixture with the air, near the surface of the liquid..." In other words, the flash point describes the temperature of the liquid that is high enough to generate enough vapor to create a flame if a source of ignition were introduced. The flash points of many flammable solvents are (well) below 0°C (32°F). Which means that even when temperatures are below freezing, the solvent is still giving off enough vapor to ignite. As a result, solvent-borne industrial coatings are routinely applied at temperatures above the flash point of the respective solvents (even at ambient temperatures), with proper precautions.

3. The concentration of vapors in the air. For vapors of flammable liquids, there is a minimum concentration below which the spread of the flame does not occur when in contact with a source of ignition. This is the Lower Flammable Limit (LFL). There is a maximum concentration of vapor in the air above which the spread of the flame does not occur. This is the Upper Flammable Limit (UFL). The flammable range is between the LFL and the UFL, when the concentration of vapors can support combustion.

4. The source of ignition. That is, something with enough energy or heat to cause the air vapor mixture to burst into flame. The source of ignition could include sparks, static electricity or open flames, or a heat source that heats the flammable liquid above its auto ignition temperature. As described more fully later, in hot-work environments, a potential source of ignition is created by the temperature of the surfaces being painted.

Applying coatings to hot surfaces increases the rate at which the solvents are driven off. When applying solvent-borne coatings to hot surfaces it must be assumed that the concentration of vapors in the air could exceed the LFL (at least for a short time after application). As with coating application to ambient temperature steel, controls must be implemented.

While the LFL is likely to be achieved over a shorter period of time during hot application of coatings than coatings work performed at ambient conditions, the resulting fire hazard exists in both applications. That is, the fire hazard and associated controls must be considered for the application of any solvent-borne flammable coating system, regardless of the work environment. It must be recognized that the fuel component of the fire tetrahedron will be present in both 'hot' and 'ambient' environments and basic steps must be taken to minimize unnecessary solvent vapors in the work area. In addition, as outlined later, attention must also be directed to eliminating the remaining element of the tetrahedron – the source of ignition.

Control of flammable vapors (fuel)

Reduce the fuel element (e.g., flammable vapors) of the fire tetrahedron by implementing basic controls such as:

1. Handle and store flammable liquids in approved, self-closing containers.

2. Keep the number of flammable liquids containers in the work area and in storage areas to the minimum necessary and within allowable (regulatory) limits.

3. Store flammable and combustible materials in approved storage areas, away from sources ofignition or heat sources.

4. Clean up spills immediately.

5. Follow good housekeeping practices in order to reduce the amount of combustible material (e.g., paper, lumber, etc.) available to provide additional fuel in the event of a fire.

6. Substitute alkaline detergents (e.g., tri-sodium phosphate) followed by surface washing with fresh water or steam cleaning and pH testing of the surface, or non-combustible solvents (e.g., 1,1,1 trichloroethane) for pre-surface preparation solvent cleaning (note: use only non-chlorinated solvents for stainless steel to avoid chloride induced stress corrosion cracking). If substitutions are made, verify that they meet SSPC SP1 and or the product data sheet.

Combustible gas indicators should be used to verify that the concentration of flammable vapors is below the LFL. Combustible gas indicators must be calibrated in accordance with the manufacturer's recommendations and must be approved for use in flammable atmospheres. Operators of the equipment must be trained in proper equipment operation. Readings should be taken in the general work area (e.g., in the vicinity of the operator) and in areas where there are potential sources of ignition (specific examples of ignition sources will be discussed later in this paper). Typically, units are set to alarm at 10% of the LFL. If the alarm sounds, coatings application work should immediately cease until the concentration of flammable vapors is controlled. The purpose of setting the alarm below the LFL is to provide a safety factor that results in control measures being implemented before there is an imminent danger of fire or explosion.

Natural ventilation may occur in the vicinity of hot surfaces. As air is heated by hot steel or equipment it rises. This 'chimney' or 'hot air balloon' effect causes (typically cooler) air to enter into the immediate work environment. This may help dilute the contaminants, and may be enough to keep the flammable vapors below 10% of the LFL. If not, additional ventilation measures are required. Regardless, monitoring of the flammable vapor concentration (i.e., LFL), will be necessary as the effectiveness of natural ventilation may be variable.

If control of flammable vapors requires mechanical ventilation, an occupational safety or health professional or engineer with experience in industrial ventilation should be consulted. At a minimum, mechanical ventilation systems should provide sufficient capacity to control flammable vapors to below 10% of the LFL by either exhaust ventilation (e.g., removal of contaminants from the work area) or by dilution ventilation (e.g., introduction of fresh air to dilute contaminants). As with combustible gas indicators, ventilation equipment must be approved for safe use in flammable atmospheres. In addition, ventilation equipment must be grounded and bonded.

This is to safely dissipate static electricity as the air moves through the ductwork and blower. The effectiveness of ventilation should be confirmed via continuous air monitoring (e.g., combustible gas indicators as described above) during coatings application. Additional ventilation, if needed, should be continuous during coatings application as concentrations may increase as more surfaces are coated during the course of a work shift, and especially on hot surfaces where the rate of vaporization is higher.

Sources of ignition

Sources of ignition

Auto-ignition

When applying coatings to hot surfaces, the first source of ignition that readily comes to mind is the heat from the surface being painted. As described above, the AIT of a substance or mixture is the minimum temperature at which a vapor-air mixture will ignite when in contact with a heated surface, without the presence of any open spark or flame. The key to controlling this source of ignition is to verify the surfaces being coated are below the AIT of the coatings being applied. While surface temperatures may be known/available in many facilities, all surface areas of the process/piping being painted and/or any equipment adjacent to the items being painted where overspray may deposit should be measured for actual surface temperature. The results should be compared to the AIT of the coating system.

Note, the author is unaware of any published 'safety factor' for the minimum difference between operating temperature and AIT. However, American Petroleum Institute (API) Recommended Practice 2216 (Ignition Risk of Hydrocarbon Liquids and Vapors by Hot Surfaces in Open Air) concludes in part:

"...In general, ignition of hydrocarbons by a hot surface should not be assumed unless surface temperature is approximately 182°C (360°F) above the accepted minimum ignition temperature for the hydrocarbon involved. Test data and field experience both indicate that the ignition of flammable hydrocarbon vapors by hot surfaces in the open air requires temperatures considerably above the reported minimum AIT of the hydrocarbons involved..."

This is not to suggest it is safe to apply coatings to surfaces above the AIT of the specialty coating, but it does indicate that some margin of safety above the AIT may exist. Note that the API Recommended Practice was developed with specific intent in mind. Therefore, the author recommends that occupational safety and health professionals or process safety/engineering staff of the facility owner be consulted in order to establish a practical safety factor. In all cases, the use of any safety factor should require that all other controls (combustible gas monitoring, other sources of ignition, etc.) are fully implemented.

Like all industrial painting projects involving flammable or combustible coatings, all sources of ignition that could ignite solvent vapors produced during coatings application should be removed from the work area or otherwise controlled (e.g., lock out/tag out). This includes any open flames (e.g., smoking) or equipment with internal combustion engines (e.g., forklifts), electrical equipment, and electronic equipment (e.g., cell phones and laptop computers) not approved for use in hazardous locations. Such sources should be controlled in application areas as well as mixing areas or other areas where flammable vapors may be present.

Static electricity

While auto-ignition and open sources of ignition may be readily apparent, a more subtle but nonetheless critical source of ignition to control on any industrial painting project involving flammable solvents involves the production of static electricity. Equipment associated with the spray-painting operation, such as spray-application equipment and ventilation equipment, can generate static electricity. Static electricity is generated by the contact and separation of dissimilar materials. For example, static electricity can be produced when a liquid coating containing a flammable solvent exits a spray nozzle (e.g., either. during coatings application or when flushing spray equipment). During spray application (or when flushing the system), a spark, which can ignite flammable vapors, can occur between the nozzle of the spray gun and the surface being coated when there is a difference in electrical potential. The spark occurs because there is no appropriate electrically-conductive path between the two surfaces.

Providing such an electrical conductive path is the purpose of grounding and bonding. Bonding eliminates the difference in the static electrical charge potential between two objects. Grounding eliminates a potential difference between an object and the ground (earth). Grounding and bonding are only effective when the bonded objects are constructed with conductive materials. When two objects are properly bonded, charges flow freely between them and do not differ. This prevents sparking between the two objects. While bonding eliminates a difference in potential between these objects, the difference in potential between these objects and the ground is not eliminated unless one of the objects has an adequate conductive path to the earth.

Paint mixing and spray equipment (for spray application and flushing) should be grounded in accordance with the manufacturer's instructions. Grounding of equipment to be coated should also be verified (consult with the facility owner's engineering staff) prior to coatings application.

Static electricity can also be generated when transferring liquids from one container to another in mixing and storage areas. A bond wire should be provided between the two containers and one of the containers should be grounded. Be aware that containers made of non-conductive materials (e.g., plastic) cannot be effectively grounded or bonded. Only properly approved (e.g., Underwriters Laboratory) portable containers should be used.

Footwear can also be a source of static electricity. Requiring that workers use footwear that is resistant to static electricity should also be considered.

Grounding and bonding systems should be regularly inspected for electrical continuity. The grounding path can be compromised because of corrosion or other damage.

For guidance on proper grounding methods and inspection procedures, consult with occupational safety and health professionals and publications from recognized authorities in electrical and fire safety (such as the NFPA in the United States).

Spontaneous ignition

In addition to external sources of ignition, spontaneous ignition can occur when rags or wastes soaked with paint solvents are left in open containers. Spontaneous ignition occurs when the slow generation of heat from oxidation of organic chemicals (e.g., paint solvents) is accelerated until the ignition temperature of the fuel is reached. This condition is reached when the material is packed loosely allowing a large surface area to be exposed, there is enough air circulating around the material for oxidation to occur, but the natural ventilation available is inadequate to carry the heat away fast enough to prevent it from building up.

To prevent hazards from spontaneous combustion, the amount of solvent-soaked waste should be minimized in the work area (e.g., removed at the end of each work shift). When such materials must be stored in the work area (e.g., temporary containers pending disposal in a designated flammable liquid storage area), they should be kept in metal bins or containers with self-closing covers at all times.

Heat stress

Application of coatings on high-temperature surfaces increases the potential for heat-related illnesses, especially where chemical- or flame-resistant clothing is worn for personnel safety. Four environmental factors affect the amount of stress a worker faces in hot work areas: temperature, humidity, radiant heat (such as from the sun) and air velocity. Personal characteristics such as acclimatization to the heat, age, weight, fitness and medical condition also impact a given individual's potential to experience a heat-related illness.

The body reacts to high external temperature by circulating blood to the skin, which increases skin temperature and allows the body to give off its excess heat. However, if the muscles are being used for physical labor, less blood is available to flow to the skin and release the heat.

Sweating is the primary means the body uses to maintain a stable internal body temperature in the face of heat. Sweating is effective only if the humidity level is low enough to permit evaporation, and if the fluids and electrolyte lost is adequately replaced. The sweating mechanism can be impeded by protective clothing worn by the worker (e.g., full-body, flame-resistant coveralls) especially if, as in the case of chemical- or flame-resistant protective clothing, it is made of impermeable material that creates a high-humidity micro environment within the clothing.

If the body cannot dispose of excess heat that it is generating, it will store it. When this happens, the body's core temperature rises and the heart rate increases. As the body continues to store heat, one or more heat-related disorders may develop.

Heat disorders

Specific disorders resulting from heat stress include the following:

Fainting (heat syncope)

This condition can occur when an un-acclimatized worker stands in the heat. Victims usually recover quickly after lying down. Moving around, rather than standing still, will usually reduce the possibility of developing heat syncope.

Heat rash (prickly heat)

May occur in hot environments where sweat is not easily removed from the surface of the skin by evaporation. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impedes a worker's performance or results in temporary disability. It can be prevented by resting in a cool place and allowing the skin to dry.

Heat cramps

These are painful spasms of the muscles, which are caused when workers drink large quantities of water but fail to replace their bodies' electrolyte loss. Tired muscles, those used for performing work, are usually the ones most susceptible to cramps. Cramps may occur during, or after, working hours and may be relieved by taking liquids that replace the body's electrolytes.

Heat exhaustion

When fluid and electrolyte loss through sweating is not replaced, the worker will still sweat, but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin becomes clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher. Treatment is usually straightforward. The victim should rest in a cool place and drink a solution that replaces the body's electrolytes. Severe cases involving victims who vomit or lose consciousness require immediate treatment under medical supervision.

Heat stroke

This is the most serious heat disorder. It is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excessive heat. Signs include mental confusion, delirium, a body temperature of 106°F (41°C) or higher and hot, dry skin which may be red, mottled or blushed, loss of consciousness, convulsions, or coma.

It should be noted that when wearing chemical- or flame-resistant protective clothing, areas of the skin underneath protective clothing may still be wet due to lack of sweat evaporation. Victims of heat stroke may die unless immediate medical treatment is provided. Prompt first aid and emergency medical services are essential to prevent permanent injury to the brain and other vital organs.

Inhalation hazards

Preventing heat stress

Heat-stress related health problems can be prevented or the risk minimized by implementing some basic precautions. Control measures that should be considered include the following:

Engineering controls

Cooling fans can reduce heat in hot locations. However, ventilation equipment should be approved for locations where flammable vapors are present.

Work practices

Workers should drink plenty of water – as much as a quart/liter per worker per hour. Supervisors should permit workers to interrupt their work if they are exhibiting signs of heat stress or are feeling excessive discomfort. Alternating work and rest periods with longer rest periods in a cool area (or at least an area with spot cooling and not exposed to direct sunlight) on a scheduled basis can also be an effective control.

Training

Workers and their supervisors should be trained to recognize and treat heat-stress related disorders as well as control measures, such as the importance of fluid replacement. Employees should also be encouraged to maintain a healthy lifestyle including proper diet and body weight.

Personal protective equipment

Equipment that cools the micro environment inside respiratory protection and chemical- and flame-resistant protective clothing can be considered. For example, vests with removable ice packs can be worn under chemical protective clothing and supplied-air respiratory protection can use vortex systems to cool breathing air supplied to a helmet. Advanced technology body suits with integral recirculating cooling systems can be considered. Where chemical- or flame-resistant protective clothing is used, occupational safety and health professionals and equipment vendors should be consulted to determine the appropriate level of clothing needed. Using coveralls that provide more chemical resistance than is necessary will increase the level of heat stress experienced by the worker.

Workers may be exposed to solvent vapors during coatings application. This is especially true when solvent-borne coatings are applied to hot surfaces or in hot environments as the heat will likely increase the rate of solvent evaporation and increase the (short term) concentration in the air (i.e., the solvent vapors will be driven out of the coating quickly, but the vapors will also dissipate over a shorter duration as the solvents in the coating are quickly exhausted).

If high-temperature coatings are applied via spray application, the spray gun atomizes the coating during application resulting in the generation of airborne mists in addition to vapor from the evaporation of solvents. These mist droplets may contain volatile solvents and also both semi-volatile and non-volatile ingredients (e.g., silica).

Like all industrial coatings operations, employers should evaluate high-temperature coating tasks to determine whether steps should be taken to control respiratory hazards. The hazard determination will vary depending upon what materials may become airborne, their concentration, and their physical state (e.g., vapor and mist). The hazard determination should be made in consultation with an occupational safety and health professional after review of product and material data sheets and consideration of the method of application (e.g., spray application or brushes/rollers). Concentration can be estimated using methods such as mathematical modeling or air sampling.

Control methods

In general, control measures should be instituted for inhalation hazards when the occupational exposure limits for airborne hazards are likely to be exceeded during coating application. Information on occupational exposure limits can typically be found on Safety Data Sheets or Material Safety Data Sheets and applicable regulatory standards.

Engineering controls

Engineering controls (e.g., mechanical ventilation) should be used to reduce airborne concentrations of inhalation hazards to as low as feasible before relying on respiratory protection.

General considerations for implementation of mechanical ventilation were addressed in the section on fire hazards. Effectiveness of ventilation should always be verified. The means and methods of verification should be determined in consultation with an occupational safety and health professional and can include the collection of personal air samples or the use of direct reading meters like combustible gas indicators.

Respiratory protection

Engineering controls may not be feasible or may not be enough to reduce concentrations of airborne hazards to below occupational exposure limits when applying coatings. In this case, respiratory protection will be necessary to control worker exposures.

Respiratory protection should be used in the context of a written respiratory protection program. This program should be developed by an occupational safety and health professional. As a minimum, this program should comply with applicable regulatory requirements. As an example of respiratory protection program requirements, the elements of a respiratory protection program required under the OSHA Respiratory Protection Standard include the following:

1. Procedures for the selection of respiratory protection
2. Medical evaluations for respirator use
3. Fit testing procedures (for tight-fitting respirators such as half-mask air purifying respirators)
4. Procedures for use
5. Procedures for cleaning, disinfecting, storing, inspecting, repairing, discarding and otherwise maintaining respirators
6. Procedures for ensuring quality of breathing air (if supplied air systems are used)
7. Training
8. Procedures for evaluation of program effectiveness

Burn hazards

Workers applying high-temperature coatings may come into contact with hot surfaces in the work area. Engineering controls, such as placement of insulating materials on hot surfaces, or work practices, such as lock out/tag out of hot equipment or scheduling work when hot equipment is not operational, should be considered.

Where engineering or work practice controls are not feasible, the use of protective clothing will be necessary. All areas of exposed skin that may come in contact with hot surfaces or vaporized water (if high-pressure water jetting is used as the method of surface preparation) should be protected with properly selected work clothing. Clothing made of artificial materials, such as polyester, which are not flame-resistant should not be worn (many facilities require the use of flame-resistant clothing).

If wet methods of surface preparation are used, workers may be exposed to burn hazards from water that contacts hot surfaces. All exposed skin should be protected with materials that are both water repellant and suitable for protection against skin contact with hot surfaces. Where gloves and boots are used, pant legs and sleeves should be worn over boots and gloves and the interface sealed with duct tape to prevent the entry of hot water. Face shields, goggles and hoods should be considered to protect the face and neck.

Surface preparation issues associated with hot steel

Coatings professionals agree that the better the surface preparation the better the lifecycle of the applied coatings. Many typical surface preparation methods are practical on hot steel. These include hand- and power-tool cleaning, abrasive blast cleaning, as well as high-pressure water cleaning, or a combination of methods. As indicated previously, several of these methods may require a hot-work permit in hazardous areas as they may create sparks that are not acceptable in some work environments.

Use of high-pressure water may not require a hot-work permit and may be appropriate for working on hot steel. As discussed earlier, the water may turn to steam and, therefore, proper personal protective equipment will be required. If the surface temperature of the steel is over 100°C (212°F), then the water should evaporate from the steel before there is a chance for flash rust, thus mitigating the need for any rust inhibitors that might require additional safety precautions.

Summary of safety and health considerations

The case can be made that coatings specifically designed for application to hot surfaces can be safely applied in hot environments, but unique safety and health issues must be considered.
Primarily these are:

- The surface temperature of the equipment being painted must be below the AIT of the coating system.
- Heat from process equipment and the work environment can lead to heat stress in workers and related heat disorders. Mechanical ventilation and cooled protective clothing may help reduce this risk, but work practices involving worker rotation and hydration on a routine, scheduled basis may be required.
- The rapid vaporization of solvents from applied coatings into the work environment increases the inhalation hazard for workers. Once again, mechanical ventilation and properly selected and used respiratory protection equipment can effectively mitigate this risk.
- Hot surfaces and vaporization of water (if wet methods of surface preparation are utilized) create burn hazards. Proper selection of all worker clothing and personal protective equipment is critical.

These hazards and control measures are in addition to those typical to any industrial maintenance painting project, any special hazards like work in confined spaces, and any standard protective measures (such as hot-work permits) used at the facility. Naturally, none of the above control practices will be effective without proper worker training and supervision. All parties involved with the application of specialty high-temperature coatings to hot surfaces should be medically qualified, trained in necessary work practices and controls, and monitored to verify consistent implementation of all control practices.

Conclusions

There are coatings technologies that allow for coating application on hot-steel surfaces. Applying coatings to hot steel requires a review of safety practices and must be thoroughly planned to minimize the risk of accidents or injuries. Properly addressing the safety and health issues described above may increase application-related costs. However, the fact that coatings work may be performed during normal operations and without the need for equipment shut-down can result in significant overall savings to the facility owner, especially when the facility normally operates 24/7 throughout the year. As such, proper application of specialty coatings to hot surfaces can be considered as a potential cost-savings tool for facility maintenance and repair.

About the author

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