HISTORY OF PAINT STRIPPING

Chemical Paint Stripping, Restoration Works Inc. Paint Stripping Experience,
& Paint Stripping for the Future Without the Use of Chemicals

By Gail Wallace

WHY DO WE NEED TO STRIP OLD PAINT OFF OF WOOD

Paint stripping as we know it in America has a relatively short history. Chemical stripping appears to have started in the 1970's as a faster way to remove old coatings. Non-chemical means such as sanding and scraping were most likely used before chemical stripping became prevalent. These were time consuming and not very effective. With the use of chemicals, complete and thorough stripping could actually be accomplished, even though the chemicals used came with a host of problems.

In order to restore any object, paint stripping is the first and most important step in the process. Multiple layers of paint can typically be found on older objects. As paint fails, new coatings are applied to maintain the appearance and water resistance. These layers of old paint must be removed and a clean substrate prepared so that the new finishes are not compromised. If old paint layers are not stripped off, everything added on top of the old paint will fail when the old paint fails. Older paints have different chemical bases than today's paints, which can now be chemically incompatible with modern paints or a hazard themselves. All white paint prior to 1978 used lead as a pigment. These lead based paints are a hazard to our health and should be properly removed from anything intended for future use.

Old paints can also hide wood deterioration. If you are trying to restore something, it is vital to remove the paint and reveal what the true condition of the wood is. To do repair work on wood with products such as epoxy requires that the wood be stripped so that the repair is not compromised. Leaving the old paint on and painting over it may produce uneven surfaces and ridges. For these reasons and many more, it is important to strip off old paint of wood to provide an appropriately sound substrate, and to end up with a good looking finished product.

CURRENT CHEMICAL PAINT STRIPPING PRACTICES

Chemical paint stripping requires that the existing paint be broken down. There are two main types of chemical paint removers used on the market today, caustic paint removers, and solvent paint removers. Recently, several new, non-toxic chemical stripping products have been developed and are now on the market, but they are not in wide use and some are not very effective. Caustic paint removers have a sodium hydroxide base, which is also known as lye or caustic soda. They work by breaking down the chemical bonds of the paint. Caustic paint removers change the pH of the wood and the wood must be neutralized after the old paint and chemicals are removed. If the wood is not neutralized, the new finish will fail prematurely. Solvent paint strippers predominantly have a base of methylene chloride and they work by penetrating the layers of old paint, and swelling the paint, thereby breaking the bond between the old paint and the object.

Caustic paint removers, although considered nontoxic, are very flammable, and can also burn your skin. They can soften and fur up the wood, and they do change the pH causing the end user to need to apply a neutralizer. The process is slow, taking from 12 to 42 hours to remove paint. Conversely, methylene chloride is toxic and considered a serious health risk, but works more quickly and does not alter the wood. Despite the risks, it has become the backbone of the paint removal industry. There is danger associated with the use of both chemical types, in addition to the safety

issues regarding the removal of lead based paint. Paint removal is difficult and messy; it is no wonder that many people would rather throw away good, quality objects if they must be stripped.

Yet stripping does occur and methylene chloride is still widely used as a paint stripper. It is also used as a degreaser, an aerosol spray propellant, a blowing agent for polyurethane foams, in the food industry where it is used to decaffeinate coffee and tea, in the preparation of hops for brewing, and other flavorings. Methylene chloride was first prepared in 1839 by French Chemist Henri Victor Regnault. The first United States patent for the production of methylene chloride was awarded in 1971. Since then, there have been 6,763 patents for methylene chloride related products in the United States. By 1976 there were several dozen patents for methylene chloride products so its use in the stripping industry likely begins around this time. Currently methylene chloride is produced overseas and is imported into the United States with estimated domestic consumption at 260 million pounds per year. The EPA estimates that approximately twenty five percent of the total methylene chloride usage is for paint and coatings removal.

RESTORATION WORKS INC. STRIPPING EXPERIENCE

The only method of stripping available to us when we started our restoration business back in 1983 was to use a few regional small store front companies that had dip tanks filled with methylene chloride. Their main business was restoring furniture, not stripping window sashes. These early stripping establishments were unaware of the safety hazards of methylene chloride and did not use safety equipment or incorporate any safety practices. We knew that methylene chloride had to be handled with care, but for us it appeared to be better than using any caustic chemicals which could harm the wood. While the wood sometimes needed a whole week to dry out from the chemicals, methylene chloride worked well to remove the old paint completely. While smaller stripping establishments might have been lacking, they were the only option available to us.

In 1988, to fulfill our need for coatings removal on a large scale project, we subcontracted with an industrial methylene chloride dip stripper who could produce a disposal manifest, which was required for this venture. The manifest tracked the lead waste from the time it was removed to where it was brought to for disposal, which needed to be a toxic waste disposal site. When we asked to see their stripping establishment, we assumed larger, Chicago based stripping establishments would be more sophisticated and would provide greater safety measures. They were a chemical manufacturer that had set up a tank room with two large 8' x 20' tanks for commercial stripping. The station had no natural light, making the tanks hard to see; there were no guard rails; and the air was heavy with chemical vapor as they had not ventilated the room. The window sashes were manually dropped into the large dip tank and were retrieved from the tank with a long hook. This was an industrial company, able to perform volume stripping work, which had next to no safety practices in place and no personal protective equipment for their employees except for gloves. Yet they could produce a disposal manifest because they had a licensed hauler take away toxic waste. It became clear to us that the whole stripping industry had minimal regulations.

At that time, it was thought that there were no health or environmental issues with methylene chloride. But things soon began to change. In 1992, the EPA found methylene chloride to be a health hazard and issued warnings to that effect. The acute short-term effects of methylene chloride inhalation in humans are nervous system effects including decreased visual, auditory, and motor functions, which are reversible once exposure ceases. The effects of chronic long-term exposure to methylene chloride suggest that damage to the central nervous system is cumulative and may become permanent over time. The European Union banned methylene chloride for paint

stripping in 2010, citing these effects and multiple deaths attributed to methylene chloride exposure, and the State of California has followed with their own efforts to ban the use.

There is also the problem of hazardous waste disposal and its byproducts. The world is full of harmful chemicals that can cause illness, compromise our well-being, or alter our environment; all of which must be disposed of properly. The Federal Resource Conservation & Recovery Act, established in 1976, gave the EPA the authority to control hazardous waste from the "cradle to the grave", and regulate sites for proper disposal. Unfortunately, funding was not allocated to create new waste disposal sites with proper safety protocols, so many of the sites established prior are still in use. The problems of waste generation and waste disposal don't easily go away. Reduction of the use of hazardous chemicals before they become a problem is the most effective way to limit their damage.

Between 1990 and 1998, we visited every store front stripping establishment in the Chicago Metro Area. There was no stripping establishment incorporating any meaningful safety practices or equipment into their process. When we required manifests, which stated that the toxic waste was properly disposed of, one or two stripping establishments could produce them, but there were still no deliberate safety practices incorporated into their stripping process.

In 1996 we resolved to research what was out there and perhaps establish an internal stripping station within Restoration Works Inc. Our list of requirements was long and expensive. Safety was the priority. This operation would directly impact our employees and the disposal issues would impact the world we live in. Proper disposal of scrapings and residue generated by stripping were critical, along with the collection and cleaning of rinse water. We managed to find a supplier who sold stripping equipment and had water treatment equipment for sale. They sold dip tanks, rechargeable methylene chloride that could be brought back to full potency, and a water filtration system that would filter the rinse water used after the material was dip stripped. The water could then be returned back to the sewer system. Due to lack of interest, this technology is now no longer available, but access to this technology enabled us to start our journey towards safer stripping. We designed an industrial stripping station with a large dip tank equipped with a hydraulic lift, towers and air flow systems, as well as protective suits, gloves, safety goggles, and respirators. In the end, our 2,000 ft^2 contained stripping station was the largest capital investment in the history of our company.

The stripping station had a 60 ft. wall of equipment so that the sashes could be stripped on a production basis. There were ducts of air collectors 40 ft. long, which fed into two massive air handlers with two exterior towers to draw the methylene chloride vapors away from the breathing zone. Six air intakes in the ceiling were installed to bring fresh air into the stripping station. The 4' x 8' by 5' deep dip stripping tank was loaded and unloaded by placing the windows on an engineered steel cage that was the same size as the tank. It was raised and lowered with a remote controlled electric chain hoist. No one had to endure possible splashes of methylene chloride. A 4' x 8' steel scraping table with 3" high sides was custom made so the paint shavings could be removed from the sashes and collected. The paint came off quickly.

Next, a steel catch basin with 4' high sides for pressure washing was custom made. The catch basin collected the rinse water which was then pumped into 55 gallon barrels for temporary storage. At the end of the day, the water was transferred from the temporary storage barrels into the water treatment system. Solids were precipitated out from the liquid and then the chemicals were removed by aeration. The paint shavings from the scraping tray and other solids from the water filtration system were dried out and then disposed of as hazardous waste. The final area was a drying area for the sashes. They dried much more quickly, in approximately 2 days, than other services we had used in the past, since the chemicals were always at full strength and our dip time was just 2-4 hours. Stripping subcontractors would soak the windows, sometimes as long as a week, which

caused the windows to become saturated with chemicals. This required a long drying time of at least a week or more. Our methylene chloride was recharged by adding chemical adjusters and was always at full strength. This had the added benefit of eliminating disposal of spent chemicals on a regular basis. Out workers were always properly suited and gloved, wore respirators, and used safety goggles when handling chemicals or treated items.

Around this time I joined the Chicago chapter of the United States Green Building Council and gotten to know several of their members. In 2008, a certain Board Member took an interest in what we were doing and wanted a tour of our facility and especially wanted to see our stripping station. She was very impressed, and nominated us for an award in 2009 that was given by the Chicago United States Green Building Council for voluntarily doing the right thing in your industry. She declared that we had the finest paint stripping set up in the whole Chicago Area. This stripping station was used for Restoration Works Inc. stripping for 9 years.

In 2009, 3 months after bring nominated for this award, Restoration Works Inc. experienced a fire. This fire was due to a faulty starter on one of the radiant heating units located in another part of the building, which caused an attic fire that spread throughout the building. We lost our building and our high tech stripping station. Fortunately, we had another auxiliary building with 10,000 ft^2 of space, and resumed our restoration business at that location. We were in no position to instantly set up a duplicate stripping station since all of our equipment was destroyed by the fire. After several years, we again began thinking of the possibility of again establishing an internal stripping station. By that time, we had evolved in our green practices and wondered if we could establish a stripping station that did not require the use of chemicals. We again began a massive research effort.

PAINT STRIPPING FOR THE FUTURE

I headed up the effort to find a solution. After investigating what knowledge was available regarding the stripping potential of ultraviolet light, laser, and infrared, we found that there was some movement in that direction, but it was expensive technology with minimal success. Several Universities were contacted to see if there was any interest in developing a non-chemical stripping method, but to no avail. Everyone thought it was a good idea, but they lacked time and funds for this purpose. A Swedish Company had come out with a little hand held infrared stripper meant for homeowner use. We tried to apply this to our industrial production, and while we found it interesting, it was inadequate. It could only strip for about thirty minutes, and then needed to cool down and be restarted after about 15 minutes. The bulbs didn't last long and would break fairly easily, but we saw potential in the infrared if the process could be refined.

After trying for many months to find someone at the university level to collaborate with, and with the help of a local collegiate sustainability administrator, we were able to find someone who was actually doing testing on paint stripping methods that did not rely on chemicals. This scientist was an engineering professor at the University of Texas who was focused on using ultraviolet rays to strip paint off of steel. We did a series of tests with him over several months, giving him wood samples of what we typically stripped, and he used his various methods. While they worked to some extent, unfortunately none of them proved to be satisfactory. We continued over the next 2 years to experiment, making several devices ourselves using ultraviolet and infrared technologies. We also purchased and experimented with several different infrared lamps that are sold on the market. These homemade and purchased infrared lamps all proved to be unsatisfactory for industrial production stripping, but it still seemed like the infrared technology had some promise.

In our pursuit to find something that would work well, we began to focus on infrared technology. We made several more different infrared strippers, testing out different frequencies of light waves. About a year later, we found a form of advanced infrared technology that worked as

we had hoped it would. We were ecstatic and began focusing on developing this technology. We spent three years using it internally, further refining our process, and eventually applied for a patent. Our stripping device is called the Light Wave Stripper. This method of stripping proved to be amazing for our company. It is quick, efficient, and very cost effective. We reduced our toxic waste load by 90%. Through exhaustive experimentation, we developed multiple ways to utilize and apply this technology in both a shop and a field setting. We are now marketing this new stripping technology to the professional.

In October of 2017 we won an award from the Illinois Sustainable Technology Center for the Light Wave Stripper and for our other Green practices. They, like us, are very excited about the potential of the Light Wave Stripper. We hope to revolutionize the whole paint stripping industry, turning it from a chemically dominated industry to a non-chemical industry. Being a company founded on green principals, our dream would be to give a big boost to making our environment a safer, more sustainable place by eliminating or greatly reducing the use of hazardous chemicals and the waste they generate from at least one industry in America. The Light Wave Stripper makes stripping so easy; I firmly believe it can also give a boost to the concepts of Reusing, Recycling, Repairing, and Restoring that are now a part of our sustainability movement. Light Wave Stripping is one more step forward as we strive to address the bigger issues of climate change, our dwindling resources, and a healthier environment for all.

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