

**LEAD CHROMATE, TOLUENE AND METHYLENE CHLORIDE  
AEROSOLS IN EMBALMING/RESTORATIVE ART: TOXIC AND  
UNNECESSARY EXPOSURES FOR EMBALMERS.**

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*ABSTRACT: Lead chromate, toluene and methylene chloride aerosols in embalming/restorative art are discussed as serious and unnecessary hazardous exposures for embalmers. The exposure problems inherent with lead and hexavalent chromium as lead chromates is delineated indepth. The exposure hazards of methylene chloride (dichloromethane) as an aerosol is investigated and commented upon. The hazard of toluene in old-fashioned oil-based cosmetics is discussed. The general reluctance of the embalming industry to seek reduced exposure alternatives to traditional embalming chemicals is remarked upon. Acceptable low-impact, lowered exposure alternatives to both lead chromate and methylene chloride are elucidated and discussed. A summary advocates use of lowered-exposure alternatives in all phases of embalming and restorative art. An extensive bibliography completes the article.*

*CHOOSE NOT TO TAKE THE CENTURY-OLD RUTTED ROAD,  
ENVISION INSTEAD A NEW PATH.*

*– JHB*

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INTRODUCTION: The use of methylene chloride as a solvent in aerosols, with and without lead chromate as a pigment additive is rampant in the embalming industry. Numerous spray sealers, spray glues, spray coverups, spray undercoats and spray skin restoratives or opaque cosmetic sprays are available to embalmers for use in embalming/restorative art. Most all these formulations or products are archaic and based on old commercial or industrial products. Even modern industrial/commercial spray glue products are popular and are used as is and off the shelf in many embalming rooms.

The exposure hazards associated with methylene chloride as an aerosol solvent and lead chromate as a pigment additive to these cosmetic and glue sprays is enormous. In the next section of this report, I will delineate in deadly detail the inherent dangers and problems with both these chemicals in embalming use. The embalming industry, in general, shows an extreme reluctance for change and consequently, the embalming field is stocked with antiquated, outdated, archaic and needlessly hazardous chemicals and concoctions of hazardous ingredients in numerous products of dubious modern value. That's just the way it is in the embalming industry. In response to this, my prime directive as Director of Research at The Champion Company has been and always will be the replacement and elimination of needlessly toxic and hazardous chemicals in embalming formulations and replacement with preferred lowered-exposure alternatives that reduces the overall total chemical exposure to the embalmer during all phases of the embalming operation without sacrificing quality embalming results.

Methylene chloride and lead chromate are two chemicals that are totally unnecessary and have no justification for use in embalming when their exposure hazards are critically evaluated. Fortunately, there are perfectly acceptable low-impact/lowered exposure alternatives to both of these chemicals, and they can be eliminated immediately from use without the embalmer even noticing the difference. Champion makes available a lowered-exposure spray sealer that eliminates completely methylene chloride exposure while performing all sealing functions on skin for restoration. In addition, artificial skin applications that are based on low impact/low exposure liquified latex that is safely and effectively used in theater and stage formats are also available through The Champion Company. Both of these products eliminate the need for methylene chloride as a solvent and lead chromate as a pigment additive in embalming/restorative art products.

Toluene in old-fashioned greasepaint cosmetics is a leftover from the old days of embalming and is a totally unnecessary exposure hazard in modern embalming. Far superior modern, safe alternative cosmetics are available to modern embalmers. Toluene is obsolete as a cosmetic solvent and the additional exposure of the embalmer to toluene is needless. Toluene exposures can instantly be eliminated by not using oily greasepaint type makeups in embalming/restorative art.

In the following sections I will discuss lead chromate as a toxic exposure hazard, as a lead-based chemical and as a hexavalent chromium derivative. The indictment against these chemicals is ponderous indeed and further exemplifies the rationale behind total elimination of these dangerous chemicals from all embalming/restorative art operations. The exposure risks inherent in their use do not justify their existence in any products available to the embalming industry. Methylene chloride, as a sister to

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chloroform, carries massive exposure problems with it during use. After an exhaustive analysis of this hazardous solvent, you will see the justification for elimination from use in embalming rooms.

Following that section of the report will be a discussion of the modern lowered-exposure alternatives to these chemicals that are provided by The Champion Company. In this discussion you will come away knowing that acceptable embalming/restoration can be accomplished with reduced exposure and increased safety during use. A summary encapsulates the complete article and urges total elimination of methylene chloride, toluene and lead chromate in all embalming/restorative products and advocates the adoption of acceptable low-exposure alternatives in all phases of embalming operations.

**LEAD CHROMATE:** When was the last time you used lead-based paint? In fact, when was the last time you used lead-based spray paint? Probably, you think at least a quarter of a century ago, back in the 1970's, before it was banned? Right? **WRONG!** It might have been last week when you used a spray skin restorative that is popular with embalmers. Lead chromate, or chrome yellow, as it is referred to in pigment chemistry is a yellowish crystalline substance or powder that is used as a pigment or coloring agent for ceramics, paints and certain printing. The interstate shipment of this chemical was banned in 1973 for consumer use and permanently banned for all consumer use and in any products that were created for consumer use in 1977. Military and industrial use is still allowed.

Lead chromate is a highly toxic chemical and corrosive to lung tissues and implicated in lung cancers. It is classified as carcinogenic by every agency there is and IARC rates it as a Group 1 known and confirmed carcinogen — it doesn't get any worse than that. In addition to lung cancers, severe asthmatic reactions can occur along with anemia and neurotoxic effects are also noted. The exposure danger is particularly high for pregnant women and young children. Ingestion of lead chromate causes abdominal pain, nausea and vomiting. After skin contact, dermatitis and ulcers of the skin are possible. Inhalation of an aerosol is the worst possible exposure scenario and sprays containing lead chromate are considered very dangerous. Bioaccumulation is a definite problem, particularly with shellfish, but also in certain fish, plants and mammals.

The exposure limits for lead chromate are shockingly low for a solid with virtually no vapor pressure. ACGIH specifies limits of .05ppm as lead and only .012ppm as a chromium (VI) compound. NIOSH has even lower limits and are set at .001ppm, which is only 1 part per billion, an extremely low exposure limit. In addition, the Lead Standard must be complied with in any environment that meets the OSHA standards. This requires, above certain action levels, constant monitoring, medical testing of personnel and mandatory implementation of the respirator standard. Lead chromate appears on all hazardous substance lists including: OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, HHAG, EPA, AIHA, and others. This is definitely a hazardous chemical to be reckoned with. Why are we using this in the embalming room?

**LEAD CHROMATE AS LEAD:** Lead is used in industry as tank liners, pipes, paint pigments, old-style solders (that are now banned), manufacture of batteries and other uses. The biggest exposure problem

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in the environment is from aircraft fuel. Lead is now virtually banned from automobile fuel and cleaner aircraft fuels are in the works.

Lead has a propensity to attack bone tissue and is capable of destroying the nasal septum from continual exposure. Lead is slowly excreted from the human body and consequently accumulates in tissues with serious health effects. These health effects are particularly noticeable and most dangerous in young children. In addition, effects on the nervous system, reproductive system, cardiovascular system, digestive system, bone marrow and kidneys are noted. Lead is definitely teratogenic (causative agent of birth-defects) and manifests as low sperm counts and production of abnormal sperm in males and reduced fertility, birth defects, stillborns, miscarriages, low birth weight infants and neurologically damaged newborns in women of child-bearing age.

The 1974 Safe Drinking Water Act set the target level of lead in water at ZERO, with an action level of 15ppb (parts per billion). Most groundwater in the U.S. is safe, with very low levels of lead. Most all lead exposure in households is from old lead soldered pipes, that are now banned in all modern construction. Corrosion control and pH adjustments by water companies minimize this risk from old plumbing, but the problem still persists. The maximum ACGIH exposure levels for lead are .05ppm and OSHA also specifies .05ppm as a limit with mandatory compliance with the Lead Standard CFR1910.1025 and respirator standards if powders or aerosols exist. NIOSH sets the limits at <.1ppm with specified maximum lead blood levels in exposed workers. No one should use lead compounds unless absolutely necessary.

**HEXAVALENT CHROMIUM:** Chromium (VI) or hexavalent chromium is the oxidation state of chromium found in lead chromate. It is extremely toxic and very dangerous indeed. Most people had never even heard of hexavalent chromium until August 2000, when the movie Erin Brockovich, starring Julia Roberts hit the big screen. After that movie, everybody in the U.S. was made aware of what exactly this chemical is and the extreme exposure dangers associated with it. Chromium exists in several oxidation states and there is much confusion over bad chromium and good chromium. Chromium (III) compounds are very stable and are naturally occurring in certain geological strata. Chromium (III) is an essential trace element for humans and is necessary for good health, consequently, you will find it in mineral dietary supplements and referred to as good chromium. Such is not the case with Chromium (VI) or hexavalent chromium, i.e. bad chromium.

Hexavalent chromium is a known, confirmed carcinogen and rated as Group 1 by IARC and every other agency there is. Chromium (VI) is an industrially created form of chromium and exhibits many health hazards to humans. It is used for corrosion resistance, steel production auto coatings (i.e. chroming), stable pigments (such as in yellow traffic lane paint), tanning operations and occasionally as a wood preservative treatment. Industrial stainless-steel welding generates the highest exposures in industry.

Due to its high toxicity it is given a guideline by the Office of Environmental Health Hazard Assessment of .2ppb (parts per billion) established in Feb. 1999. Chromium (VI) causes renal toxicities, blood

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breakdown and gastro-intestinal hemorrhaging, contact dermatitis, ulcers, nasal septum perforation, asthma hepatic damage, renal insufficiency and failure and eye damage. ACGIH sets limits at .01ppm with OSHA specifying .1ppm as a chromate, for example in lead chromate. NIOSH sets lower limits of .001ppm which is only 1 part per billion. Who would possibly want to use this chemical in the embalming room?

**METHYLENE CHLORIDE (DICHLOROMETHANE):** Methylene chloride appears in virtually all spray glues, spray sealers, spray opaque undercoats and spray cosmetic paints in embalming. Methylene chloride has excellent solvent characteristics and is a common and preferred solvent in numerous aerosols available in hardware stores and used in industry. The problem is that it is a close sister to chloroform (just one chlorine difference) and is being used, essentially, as a chloroform replacement in many industrial and commercial products. Chloroform has massive exposure concerns and health effects and this has propelled the use of methylene chloride as an alternative. Chloroform is ridiculous in embalming and has no value in any embalming products. I have devoted an entire Champion Encyclopedia to the absurdity of chloroform in embalming, and I refer you to this article for an indepth discussion and look at chloroform in embalming and industry. The willingness of embalmers to use various dichloromethane based sprays is unfortunate, as there are alternatives with significantly reduced exposure potentials that perform more than adequately as a substitute for this hazardous chlorinated solvent. In fact, after an extensive search, I found no spray glues/sealers/coats/paints/coverups that are supplied to the embalming industry that did not contain dichloromethane other than the sealer spray provided by The Champion Company. The indictment against methylene chloride/dichloromethane exposure hazard and health concern is massive indeed and is the focus of the next part of this article.

**EXPOSURE/HEALTH HAZARDS:** Dichloromethane is a colorless liquid which gasifies at only 104 degrees F, which makes it a very volatile solvent. It basically smells like chloroform and is used as a solvent replacement for chloroform in paints and paint strippers and extraction agents in industry. Major exposure problems in industrial use are mists and aerosols, as these cause the most rapid overexposures with inducement of chloroform effects of exposure ensuing. Like chloroform, dichloromethane can be and is abused by inhalation with narcotic effects rapidly appearing with other serious health effects. This glue-sniffing of methylene chloride sprays and aerosols occurs most often in children and young adults with long-term deleterious health effects evident.

Dichloromethane is classified as a carcinogen (cancer-causing agent), a mutagenic agent and a teratogen (birth-defect causing agent). It is classed by IARC (International Agency for Research on Cancer) as 2B and NTP assigns an R designation with OSHA classifying it as a carcinogen. Virtually all other agencies world-wide classify dichloromethane as a carcinogen. Exposure limits are set at 50ppm by ACGIH and only 25ppm by OSHA. In addition, OSHA mandates a Methylene Chloride Standard (29CFR1910.1052) which requires medical surveillance, monitoring of action levels and mandatory respirator training and implementation.

Deleterious health effects are numerous with exposed workers including: dizziness, headaches, nausea, dryskin, redness, burning and tingling sensations of the skin. In addition, kidney and liver damage

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occur in exposed workers and neurotoxic effects are also noted, such as coordination disorders, memory loss and irregular brain function. Carboxyhemoglobin levels in the blood of exposed individuals are higher than in carbon monoxide exposed workers at only 66ppm methylene chloride inhalation levels. ACGIH sets a BEI (biological exposure indice) of only .4mg/l in urine for dichloromethane. The odor threshold is another serious problem with this chemical. Typically, an exposed individual cannot smell methylene chloride until 160ppm and some cannot smell it until 250ppm airborne levels. The lowest reliably reported odor threshold limits are 65ppm and higher. Consequently, all reported odor thresholds are far above the exposure limits for exposure, with the results being overexposure before detection. Basically, if you can smell this solvent you are already overexposed. Why choose to use this solvent in aerosols and sprays on a constant basis in embalming rooms when a lower-exposure alternative exists?

**THE PROBLEM IN EMBALMING USE:** The problem is obvious, these sprays of various types and brands are continually and repeatedly used by embalmers on a daily basis in embalming rooms. The exposure and health effects are cumulative and potentially serious. The embalming industry is lulled into a sense of disregard and complacency about most of the chemical products used in the embalming room because of overfamiliarity through decades of use and misuse and tends to ignore all exposures as relatively harmless and necessary. This is unfortunate, but that's just the way it is. The embalming industry has always been lethargic and slow to change with the result being the continued usage of chemicals that have massive indictments against them despite acceptable lower-exposure alternatives being readily available. Methylene chloride and lead chromate both fall into this category of needless exposures to embalmers, with their only reason for continued existence and use, is that nobody cares. The goal of The Champion Company is focused on the elimination of all unnecessary chemical exposures to embalmers in embalming operations and the elimination and replacement of chemicals in embalming that do not meet reasonable and acceptable exposures limits and guidelines. Chlorinated solvents and chlorinated chemicals in general are exposures that are unnecessary exposure risks in embalming rooms. The Champion Company has stopped supplying these chlorinated aerosols to the embalming industry, despite requests from embalmers for them. The exposure potential is just not worth it, when acceptable alternatives exist.

**THE SOLUTION:** Champion provides an excellent alternative resin-based spray sealer that eliminates chlorinated solvents entirely and instead uses an acetone/alcohol based dispersal aerosol that drastically lowers airborne exposure values overall. This product, a shellac extract-based sealer spray, dries quickly and smoothly to a sealed, firm surface that is easily cosmetized over for maximum restorative effect. The problems and exposures of dichloromethane is eliminated and overall chemical exposure during use is minimized. There is no reason for embalmers to continue to use industrial/commercial spray glues and sealers that were intended for the construction and painting industry.

Lead chromate can immediately be eliminated by judicious use of alternatives that Champion provides to embalmers for restorative art. Champion provides an easily applied lowered-exposure latex-based artificial skin in liquid form that covers and seals effectively repaired skin areas and can easily be

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cosmetized over when dry. This product is easily applied with a brush in thin or thick layers, if necessary, and forms a solid base for restorative cosmetic work. This product is famous in theater and stage applications and has been successfully used for years as an artificial skin applique for a variety of theatrical effects. This skin replacement eliminates completely the need for any pigment sprays or undercoats that contain chlorinated solvents or lead chromates as coloring agents. Champion will not supply these needlessly dangerous spray paints to embalmers, despite numerous requests. The exposures and health concerns are just not worth it, when the alternatives exist.

TOLUENE: While we are discussing cosmetics and restorative art, there is one other chemical that is continually found in cosmetics in the embalming industry that has little or no justification for its use, and that is toluene. Toluene is essentially used in industry and commerce as a benzene replacement and its primary end use is as an aromatic hydrocarbon additive to gasoline to bump up the octane rating. What is toluene doing in embalming cosmetics? Toluene is an old-fashioned aromatic hydrocarbon solvent for use in archaic greasepaint cosmetic pigment coverups. Many of the brands of embalming cosmetics were originally based on turn-of-the-century, oil/greasepaint cover films that were used in theater and stage in the late 1800's and early 1900's. These greasepaints evolved from the vaudeville-type clown makeups (e.g., blackface, whiteface, yellowface, reface, etc.) that became famous in theater long before motion pictures. Early undertakers adapted or copied these oily pigment cosmetics as makeup for corpses. These heavy, oily opaque coatings of cosmetics were especially effective in covering up discolorations and the "putty-greying" death pallor of a formaldehyde embalmed body. They were typically supplied to undertakers as an oily liquid make-up or a greasy pancake wipe-on solid that was doped with talc.

Shockingly, little has changed in almost a century and the embalming industry supplies and uses an enormous quantity of these obsolete and archaic oil-based cosmetics. Unfortunately, toluene or some other hydrocarbon is invariably necessary to solvate the pigments in the oil or grease base carrier. Consequently, there is continual toluene and hydrocarbon mineral spirits exposure to embalmers because we prefer to use obsolete, oil/grease-based coverup cosmetics. The cosmetic results using these ancient formulations leaves a lot to be desired and does not produce a natural and lifelike appearance to the body. Translucency is non-existent, opacity and cloudiness is maximized in a deleterious way and natural texturing is virtually impossible to achieve. Why do we continue to use obsolete and old-fashioned solutions to modern embalming problems?

There are modern, high-tech formulated cosmetics available on the market that perform excellently in modern embalming cosmetology and restorative art. These modern alternative cosmetics are hazard free and function as good or better under all embalming scenarios as the old-fashioned greasepaints. The alternative that Champion provides to the embalming industry is a complete aloe/water-soluble based line of cosmetics that function as coverup, coloring and highlighting, lip tints, and blushes. The toluene and other solvents are eliminated as well as the oil/grease carrier base. The new alternatives can easily be removed without the use of drywash/cleaning solvents, as they are water soluble and cleanup involves no more than simple soap and water. The final cosmetic result is overall excellent and actually

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improved compared to the old-fashioned opaque oil paints. With these alternatives available there is no justification for the continued use of toluene/hydrocarbon solvated, oil/grease-based makeup in modern embalming and restorative art operations.

**SUMMARY/CONCLUSION:** Lead chromate and methylene chloride are exposure hazards in embalming products that we can completely do without. Toluene is an exposure concern and is totally unnecessary for modern embalming and cosmetology/restorative art. Nothing justifies the continued use of any of these chemicals in embalming rooms with their potentials for exposure to embalmers and cosmetologists. Acceptable and superior alternatives exist to these chemicals and solvents in embalming. No embalming results or efficacy is sacrificed with the abandoning of these dangerous exposures.

The absolute goal in embalming should always be: 1. Elimination or replacement of toxic and dangerous exposure hazards with lower-exposure alternatives in all instances, 2. Selection of a chemical mix that delivers acceptable embalming results with a total overall reduction in chemical exposure to the embalmer. This goal should never be compromised. As always, embalm smart, embalm safe.

**BIBLIOGRAPHY:** As expected, the literature on these hazardous chemicals is massive. The research on lead and lead-related compounds is daunting. The indictment of chromium (VI) as chromates and related compounds is considerable. Methylene chloride has been exhaustively investigated as a surrogate chloroform, with all the exposure and health effects cataloged. Toluene has a sizable research literature that has nothing good to say about it. Consequently, the following is but a small sampling of the voluminous research literature on these chemicals.

Lead Chromate: Haz-Map: Occupational Exposure to Hazardous Agents., online ed., National Library of Medicine., Bethesda, Maryland., 2004.

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