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**TO:** Director, National Institute for Occupational Safety and Health

**FROM:** Iowa FACE      Case No. 2012 IA 009      Report Date: 11 September 2012

**SUBJECT:** Bathtub refinishing technician died from inhalation of paint stripper vapors

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#### **SUMMARY**

In 2012, a 37-year-old female technician employed by a surface-refinishing business died from inhalation exposure to methylene chloride and methanol vapors while she used a chemical stripper to prep the surface of a bathtub for refinishing. The technician was working alone without respiratory protection or ventilation controls in a small bathroom of a rental apartment. When the technician did not pick up her children at the end of the day, her parents contacted her employer, who then called the apartment complex manager after determining the victim's personal vehicle was still at the refinishing company's parking lot. The apartment complex manager went to the apartment unit where the employee had been working and called 911 upon finding the employee unresponsive, slumped over the bathtub. City Fire Department responders arrived within 4 minutes of the 911 call. The apartment manager and first responders reported a strong chemical odor in the second story apartment. There was an uncapped gallon can of Klean Strip Aircraft® Low Odor Paint Remover (80-90% methylene chloride, 5-10% methanol) in the bathroom. The employee's tools and knee pad were found in the tub, suggesting the employee had been kneeling and leaning over the tub wall to manually remove the loosened original bathtub finish coat.

The factors contributing to this lethal exposure include use of a highly concentrated methylene chloride chemical stripper having poor warning properties ("Low Odor"); working in a small room without local exhaust ventilation to remove chemical vapors or provide fresh air; and working without a respirator that could have protected the employee from exposure.

The following recommendations are made to prevent future occurrences:

1. *Provide all employees with training regarding the hazardous substances in their work area at the time of initial assignment and when new chemical hazards are introduced, in accordance with OSHA's hazard communication standard.*
2. *Substitute less hazardous products or methods to remove tub or sink surfaces that do not involve methylene chloride compounds.*
3. *Use methylene chloride-based products only in areas that can be adequately ventilated with both local exhaust ventilation and fresh make-up air.*
4. *Use an appropriate NIOSH-certified air-supplied respirator for methylene chloride or other chemical exposures, adhering to all components of an OSHA respirator program, including exposure monitoring, medical approval, respirator selection, training, and fit testing.*
5. *If using methylene chloride based products, adhere to requirements of OSHA's methylene chloride standard regarding hazard communication, regulated areas, exposure monitoring, medical surveillance, and exposure control methods to maintain exposures below the Action Level.*
6. *Notify other individuals (non-employee occupants, neighbors, employees of other businesses working on site) working near or in locations where methylene chloride may be used of the hazards and of restricted regulated areas that cannot be entered.*

## **INTRODUCTION**

A 37-year-old female technician employed by a surface-refinishing company died from exposure to methylene chloride and methanol vapors at a rental apartment while using Klean Strip Aircraft® Low Odor Paint Remover to prep the surface of a bathtub for refinishing. The Iowa FACE program learned of the fatality from the responding County Medical Examiner the day after the fatality, and initiated an investigation. Iowa FACE conducted telephone interviews with the County Medical Examiner, responding city police investigators, the Iowa Occupational Safety and Health Enforcement (Department of Labor, DOL) fatality investigator, the manager of the apartment complex where the fatality occurred, and the decedent's employer who owned and operated the refinishing company. An on-site Iowa FACE investigation was scheduled subsequent to the investigation conducted by the Iowa DOL. Iowa FACE conducted a site visit at the apartment complex where the fatality occurred and interviewed the victim's employer at the refinishing business's office within two months of the fatality. Information from the County Medical Examiner report, State Medical Examiner Autopsy, responding police department reports, and IOSH citation notification were also used to develop this case study.

## INVESTIGATION

The fatality occurred during early 2012, in a second-story apartment of a multi-apartment complex (Exhibit 1). The apartment was accessed by a single exterior door, via an exterior stairway at the end of the building. The manager of the apartment complex noted that it was common practice to contract for bathtub refinishing services when needed, in preparation for leasing to new renters. The day of the fatality was the third or fourth time this resurfacing business had worked at this apartment complex. The apartment manager recalled that the decedent had worked at the apartment complex on at least one of those occasions prior to the fatality.



**Exhibit 1: Fatality occurred in upper right apartment**

The decedent had been employed for 19 months as a technician by a local small business that specialized in resurfacing tubs, sinks, countertops, and tile. The surface refinishing business's clients included apartment complexes and private residences. The business was started in 2000 by the current owner-operator, who researched the resurfacing industry and purchased a regional distributorship from a larger national company. At the time of the fatality, the local business employed three individuals: the owner, a technician employed for five years, and the decedent, all of whom performed resurfacing jobs. The decedent and the other technician were paid by the hour and received a commission for the work they performed that exceeded two standard refinish projects per day.

The decedent had no experience in the resurfacing industry prior to this job. When she was hired, she was provided approximately 60 days of on-the-job training regarding specific work procedures to strip, clean, prepare, and recoat surfaces. She was trained primarily by the owner/operator, and she accompanied her coworkers on jobs three to four days per week to learn and assist with procedures prior to performing her own resurfacing jobs alone. The decedent had access to the same procedure manual of work techniques that was provided to the employer at the time he was trained by the company selling the distributorship. The procedure manual did not include a specific section on safety topics, including hazard communication for the chemicals used or personal protective equipment. The procedure manual did include the following instructions related to ventilation as part of the refinishing process:

- Open any doors and windows if available when using stripping compounds.
- Do not operate room exhaust fans (to avoid drawing chemical vapors through the employee's breathing zone).
- Use a ventilation blower to exhaust chemical vapors out an available exterior window or door.

The local resurfacing business did not have a formal safety program in place. There was no dedicated initial or periodic safety training provided either to the business owner at the time he was trained or by the local owner to the two employees regarding chemical hazards, exposure control methods, or personal protective equipment. No environmental monitoring had ever been performed to assess employee exposures. The owner reported having no prior exposures or symptoms from the chemicals used.

The owner stressed to employees the reasons for following outlined procedures and trained the employees to maintain and organize their tools and equipment. Each employee was provided their own set of tools and equipment to perform their jobs. The materials were to be organized and stored in three large plastic tote tubs, containing a) chemical products; b) tools and supplies (scrapers, paper towels, sponges, knee pads, masking tape, papers, plastic sheeting, etc.); and c) a Pro-Air 40 Fresh Air Respirator that delivered filtered air from the turbine location through 40 feet of 5/8" tubing to an elastomeric half-mask face piece (Exhibit 2). Employees were instructed to place the turbine in a location where there was uncontaminated air. An additional 40 feet of delivery tubing was available for using the turbine remote fresh-air locations up to 80 feet from the user. The manual for the Pro-Air 40 states the turbine is to be placed in an area with fresh ambient (Grade D or better) air, and that the respirator is not to be used in environments that are Immediately Dangerous to Life and Health (IDLH). There were no components of an OSHA respirator program in place at the business.



**Exhibit 2: ProAir 40 Fresh Air Respirator was to be used while stripping bathtub surface**



**Exhibit 3: FlowPro utility blower (in foreground) was to be used to exhaust chemical vapors from the work area**

Employees were also directed to use a portable Q Standard Utility Blower (12-inch diameter fan, 2905 cubic feet per minute, 4/7 horsepower, Model 39012) with Q Standard Ventilating Hose (12-inch diameter, 20-foot, Model 177771) flexible duct to remove contaminated air from the work area and exhaust it outside to a location remote from the respirator air supply source (Exhibit 3).

Technicians were instructed to place the blower unit fan in their work area, with the ducting extending out through a door or window to exhaust contaminated air from (i.e., blow air out of) the room. Makeup air – which would replace the air being exhausted by this utility blower – was not mechanically provided for during the procedure, but theoretically would passively enter the room or apartment via any open doors or windows, including the exterior door through which the blower ductwork was extended.

This company's bathtub refinishing jobs typically took 3.5 to 4 hours to complete, which involved removing the old coating, prepping the exposed surface, and applying a spray-on urethane coating. In good circumstances, an employee could refinish two tubs during one work day. Removing the old coating required covering the floor, masking and protecting adjacent surfaces of the work area, and then applying Klean-Strip AIRCRAFT® Low Odor Paint Remover to the inside of the tub. This product contained 80-90% methylene chloride (per MSDS; 82.1% per Regulatory Data Sheet); and 5-10% methanol. The product is a viscous liquid with the consistency of wall-paper paste, that was applied by pouring ¼ of a 1-gallon can into the tub, and using paper towels to spread a thick coating of the product on the tub floor and vertically up the tub walls. A second ¼ of the 1-gallon can was poured into the tub and spread to cover the remaining areas, eventually covering the interior of the tub. Employees were instructed to use the Pro-Air 40 Fresh Air Respirator and double layers of latex disposable gloves while applying this paint remover. Room exhaust fans were to remain off, to prevent drawing chemical vapors up through the breathing zone. Following application, the paint remover needed at least 15 minutes to set up, after which it would loosen and peel, or "melt" the old bathtub coating from the tub surface. During the waiting period, the technician would usually leave the room to prepare equipment and supplies for the next steps to clean and recoat the tub. Once the original coating had loosened, the technician would remove the debris, using scrapers and abrasive cleaners to assist with stubborn areas or multi-layers of old coatings. The entire process of removing the old coating and subsequent clean-up typically took 1-1.5 hours. Recoating the prepped tub surface involved cleaning the surface, applying a bonding agent, and applying 3 coats of urethane using a high velocity-low pressure paint sprayer. This recoating process usually took 3-3.5 hours.

On the day of the fatality, the technician called her employer around 1300 to let him know she was finishing a prior job and that she would then go to the apartment complex to start her next job. The apartment complex manager said the technician arrived at around 1500 in a company van. She spoke with the manager for 10 to 15 minutes, and the manager provided a key to the unoccupied second story apartment where the tub was located. They discussed that the tub had chips and dings in the existing coating. At 1527, the technician sent a text message to her employer stating that there were "chips in (the old) coating everywhere" and that the manager approved removing this coating. In the text message, she asked her employer if it was OK for her to finish the job (i.e., apply the new surface coating) the following morning.

At around 1930, the technician's father contacted her employer because the technician had not picked up her children from child care. When the technician did not answer her cell phone, the employer drove to their business site and noted the technician's personal vehicle was still at the parking lot; he then called the apartment complex manager to ask if the company van was on site. The apartment manager saw the van and went to the apartment to look for the technician. The manager found the technician in the unlocked apartment; she was unresponsive, slumped over the

side of the tub with her forearms in the tub. The manager immediately called 911 at 1954 and first responders from the local fire and police departments arrived. The victim was pronounced deceased at 1958. The employer, additional police officers, and medical examiner also arrived in the evening and conducted an investigation.



**Exhibit 4: Configuration of bathroom**

The decedent had been working in a small bathroom that was approximately 5' wide x 7.5' deep x 8' high (Exhibit 4). The standard size bathtub (29" wide x 60" long) was on the far end of the room and extended the width of the bathroom. The room had a ceiling exhaust fan which was not turned on. Most of the original tub finish had been removed, and the decedent's scraper and knee pad (presumably used as a cushion) were found in the tub (Exhibit 5).

Responders described a strong chemical odor in the apartment. An open one-gallon can of Klean Strip Aircraft® Low Odor Paint Remover was found in the room, with about 105 ounces of product remaining in the 128-ounce can (Exhibit 6). The door and windows of the apartment were closed, and there was no supplemental ventilation supply or exhaust in use.



**Exhibit 5: Bathtub where technician was found**



**Exhibit 6: Recapped can of methylene chloride paint remover found in room**

The decedent was wearing a short sleeved tee-shirt, painter pants, and two layers of latex gloves (Exhibit 7). She wore no respiratory protection or eye protection. The decedent's cup of fountain pop was on the counter of the vanity in the room. The employee's Pro-Air 40 Fresh Air Respirator with two 40-foot sections of supply tubing and FlowPro utility blower with two 20-foot sections of flexible duct were found in the cargo area of the company van the decedent had driven to the site.



**Exhibit 7: Gloves used by technician**

Based on the product volume removed from the gallon can, the Iowa DOL Occupational Safety and Health Bureau calculated a potential concentration of 23,000 parts per million methylene chloride in the room, in excess of the IDLH concentration (2300 ppm), OSHA STEL (125 ppm) and PEL (25 ppm). [Air in this room would be flammable when methylene chloride concentrations reached 120,000 ppm.]

The IDOL issued the business the following citations for violations of the Iowa Administrative Code, Section 875, Chapter 10: General Industry Safety and Health Rules:

- |               |  |
|---------------|--|
| CFR 1926.20   | general safety and health provisions       |
| CFR 1926.21   | safety training and education              |
| CFR 1926.95   | criteria for personal protective equipment |
| CFR 1910.1052 | methylene chloride                         |
| CFR 1910.134  | respiratory protection                     |
| CFR 1926.152  | flammable and combustible liquids          |
| CFR 1910.1200 | hazard communication                       |

**CAUSE OF DEATH**

The Iowa Office of the State Medical Examiner reported the cause of death as inhalation exposure of paint remover containing ammonia, methanol, and methylene chloride. Autopsy findings included elevated blood level of methyl alcohol (7.0 milligrams per deciliter); elevated blood level of methylene chloride (120 micrograms per milliliter); pulmonary edema and congestion; congestion of the conjunctivae; hyperemia of the small bowel and gastric mucosa; and dilated right ventricle.

## RECOMMENDATIONS AND DISCUSSION

**Recommendation 1:** *Provide all employees with training regarding the hazardous substances in their work area at the time of initial assignment and when new chemical hazards are introduced, in accordance with OSHA's hazard communication standard.*

Had the employer who owned the distributorship and his hired employees been trained regarding the hazardous chemicals used in their procedures, they likely would have been more motivated to use proper exposure controls such as local exhaust ventilation, makeup air, and proper respiratory protection to limit their exposures to methylene chloride and other compounds. When the employer purchased the distributorship, he received no information with respect to acute and chronic health effects of methylene chloride and the fact that methylene chloride has poor warning properties. The lack of warning properties emphasizes the importance of ventilation and respiratory protection controls while using the product in all scenarios, but particularly in small work areas. The employer's technicians were, in turn, likewise uninformed of potential consequences of acute exposures; the proper selection, use, and limitations of respirators; and the potential for fire hazards when using methylene chloride strippers in poorly ventilated areas. There was no written hazard communication program, chemical list, or Material Safety Data Sheets (MSDS) on site for refinishing chemicals used; no substance data sheet included in the methylene chloride standard; and no training in compliance with the hazard communication standard. Specific information regarding health hazards and proper protection would have emphasized the danger of exposure that was not well described on the Klean-Strip AIRCRAFT® Low Odor Paint Remover container; the product information on the gallon can emphasized health risks of ingestion, chronic exposure, and skin and eye contact, more than risk of unconsciousness and death due to inhalation; these risks are identified on the product MSDS.

Labeling information on the one-gallon can of states: *THIS PRODUCT IS DESIGNED FOR APPLICATION BY TRAINED PROFESSIONALS USING PROPER EQUIPMENT UNDER CONTROLLED CONDITIONS. THIS PRODUCT IS NOT INTENDED FOR SALE TO THE GENERAL PUBLIC.* The business owner at this site purchased the product locally from a retail supplier specializing in coatings, hardware, solvents, and spray equipment; the product is currently available to the general public through coatings suppliers and automotive supply companies in brick and mortar stores, and through online sales (e.g., amazon.com)<sup>1</sup>. While chemicals may be generally available to the public for purchase and use, employers must understand and communicate the hazards of workplace chemicals to all affected employees, whenever chemical uses are greater in duration or frequency than those of a common consumer<sup>2</sup>. The product label indicates that this material is *not* intended for use by the common consumer, necessitating chemical-specific training.

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<sup>1</sup> Klean Strip AIRCRAFT® Low Odor Paint Remover was available for purchase from local and online sources at the time this report was prepared.

<sup>2</sup> See OSHA letter of interpretation dated January 9, 1990:  
[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=INTERPRETATIONS&p\\_id=19904](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=19904)

**Recommendation 2:** *Substitute less hazardous products or methods to remove tub or sink surfaces that do not involve methylene chloride compounds.*

Methylene chloride-based paint remover is part of a proprietary process of the parent company selling the distributorship. The methylene chloride stripper is viewed as a preferred stripping method in preparation for a bonding agent and urethane coating, in contrast to acid-etching procedures to remove finishes in preparation for epoxy coatings. This aircraft grade paint remover that was recommended by the parent company and used by the local business is marketed for large scale work in outdoor or high-volume areas where high concentrations are less likely to occur than in small bathrooms of apartments, residences, hotels, or other bathrooms where refinishing may be an attractive low cost option to replacing bathroom fixtures.

In this case, the employer returned to finish the tub stripping and resurfacing a few days after the fatality; he avoided using the usual methylene chloride stripper and instead completed the stripping process manually, using scrapers and sanding. This manual process is likely to take longer, but would avoid chemical exposures. Other alternative products that are low-toxicity - such as benzyl alcohol or soy-based stripping products - should be considered, to determine if these low-hazard products can achieve the efficacy of methylene chloride products even if the method may take longer to work.

**Recommendation 3:** *Use methylene chloride-based products only in areas that can be adequately ventilated with both well-designed local exhaust ventilation and fresh make-up air.*

A 2905-cfm utility ventilation blower with two 20-foot sections of flexible ductwork was found in the work van that the technician drove to the site. This equipment was in the van with a portable hand cart to transport her storage totes of supplies and equipment. It is not known why, on this occasion, the decedent did not use ventilation controls and respiratory equipment, since apartment personnel had on prior occasion seen her use this equipment. Since the utility blower was not known to have malfunctioned or had operating problems, possible explanations may be that:

- a) the employee perceived that bringing the equipment up a flight of steps was too awkward or difficult to manage;
- b) perhaps she did not want the apartment's exterior door open to cold air (outdoor temperature was 36 °F when the technician arrived and then texted her employer at 1527); the respirator turbine would have been placed in "fresh" outdoor air, and the utility blower duct would also have run out this door to exhaust bathroom air, had she used it,
- c) she may have opted to avoid obstructing access to other second story apartments by not placing the blower's flexible duct along or across the walkway (Exhibit 1); however, if it was not possible to effectively ventilate this small bathroom areas without obstructing the exterior hallway, an alternative chemical or mechanical stripping method should have been used; or
- d) she perceived the available floor space area in the bathroom (about 16.5 ft<sup>2</sup>) would have been too restrictive with the utility blower also in the room.

The actual reasons for not using the exhaust ventilation and respirator were not known. Nor was it known if the technician on other occasions had omitted these safety measures with no ill consequences. This large utility blower and duct system, placed on the bathroom floor in the room

with the technician, would be an improvement to no ventilation, but provisions must be made for clean supply or “makeup air” for the exhaust system to work properly. A better option is to locate a local exhaust hood closer to the stripper product, since the tub wall and even the technicians themselves could potentially block the direct pathway of contaminated air at the source to the fan.

Using appropriate makeup air and local exhaust ventilation in a push-pull system would have diluted methylene chloride vapors in the room. Because methylene chloride has a high vapor pressure and is heavier than air<sup>3</sup>, the better alternative is to position an exhaust hose to the side and as low to the interior of the tub as possible to draw vapors down and away from the worker who may be leaning over the tub to work. Capturing and removing vapors closer to the source is a more effective exhaust.

**Recommendation 4:** *Use appropriate NIOSH-certified respiratory protection for chemicals in use, adhering to all components of an OSHA respirator program, including exposure monitoring, medical approval, respirator selection, training, and fit testing.*

There was no formal respirator program in place at the decedent’s place of business. There was no protocol for proper selection of respirators based on calculated or documented exposure data, medical approval, fit testing, or training on limitations and proper operation of respiratory protection. Workers required to wear respiratory protection in environments with methylene chloride are required to use supplied-air respirators, as air-purifying respirators do not adequately protect the worker.

There are several shortcomings of the half-face Pro-Air 40 respirator device available to the surface refinishing employees. The Pro-Air 40 is not included in the NIOSH Certified Equipment List and does not meet minimum respiratory protection requirements for methylene chloride exposure. (The Pro-Air 40F – “F” designating for use with full face mask – is currently certified with approval number 19C -0320.) Pro-Air 40 systems are marketed online at several vendors and described as “NIOSH-approved” respirators, which misleads prospective users of the capabilities and protection provided by the respirator.

The configuration and protection factor of the Pro-Air 40 Fresh Air System does not meet criteria for methylene chloride exposure that may reach IDLH concentrations. Additionally, half-face mask configurations do not protect the eyes from irritation caused by methylene chloride vapors. The proper respirator for exposures up to 5000 ppm is an atmosphere-supplying respirator with full face mask, operated in pressure demand or positive pressure mode.

The Pro-Air 40 system used by the company instructs users to place the turbine in fresh ambient air of Grade D quality<sup>4</sup> or better. The Pro-Air 40 turbine unit includes two high efficiency particulate air (HEPA) filters that are replaceable but users do not have good indication to gauge a pressure drop if airflow is restricted or decreased due to turbine malfunction or filter loading. Using this system

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<sup>3</sup> Vapor pressure of methylene chloride = 350 mm Hg at 68 °F; Vapor density of methylene chloride = 2.9 (air = 1).

<sup>4</sup> For Grade D breathing air requirements see OSHA standard on respiratory protection: 29CFR1910.134(i)(1)(ii) which addresses requirements for oxygen content; allowable levels of hydrocarbons, carbon monoxide, and carbon dioxide; and odor.

within a room or apartment or even interior area of a home or business would provide no protection from methylene chloride vapors that would bypass HEPA filters and re-entrain into the supply system. Using this system in the winter, placing the turbine outdoors in a “fresh air” environment may have resulted in uncomfortably cold air being delivered to the wearer; it is not known if this deterred the technician from using the respirator equipment in her van. Although two 40-foot lengths of 5/8” tubing were found in the van that could have allowed an outdoor placement of the turbine, the NIOSH certification (for the Pro-Air 40F) specifies only an approved length of 40 feet. The technician and employer were uninformed of the limitations of this type of respirator, although it was recommended by the parent company selling regional distributorships. The employer was unaware that only full-face atmosphere-supplying respirators are approved for methylene chloride.

A formal respirator program would have assigned responsibility for proper selection, maintenance, use, and employee training, and assured that proper fitting full-face respirators were available for employees. The appropriate respiratory protection for methylene chloride exposures that could reach IDLH concentrations is a full-face, supplied-air respirator.

If methylene chloride-based paint removers continue to be used, they should be used only with positive pressure supplied air systems such as self-contained breathing apparatus (SCBA) or airline respirators with SCBA backup, especially when exposure concentrations are not known or if it is not possible to effectively ventilate the work area. Workers and bystanders should not rely on odor as a warning property for dangerous exposures, as the odor threshold (250 ppm) is 10 times the OSHA Permissible Exposure Limit (PEL, 25 ppm) and near the 15-minute short term exposure limit (STEL, 125 ppm). Direct-reading equipment would be needed to determine hazardous concentrations of methylene chloride on site. Examples of direct-reading equipment include detector tubes, which allow “grab samples” or air to be collected that show the presence and concentration of vapors tubes that change color, or portable direct reading instruments

Respiratory protection must be used for exposures exceeding the OSHA PEL and STEL. Respiratory protection is recommended for exposures above the OSHA Action Level (12.5 ppm). Methylene chloride is classified by IARC as “possibly carcinogenic to humans” (IARC, Group 2B) and by DHHS as “reasonably expected to be a human carcinogen” (DHHS National Toxicology Program, Report on Carcinogens). Exposure to potential carcinogens should be reduced to the lowest level that is feasible through substitution, engineering, and personal protective equipment controls.

**Recommendation 5:** *Review stripping chemicals to determine whether they contain methylene chloride and adhere to requirements of OSHA’s methylene chloride standard regarding hazard communication, regulated areas, exposure monitoring, medical surveillance, and exposure control methods to maintain exposures below the Action Level.*

The methylene chloride standard requires employers to monitor and document exposures of those employees working where methylene chloride is present. In this case, no exposures had been determined, either with or without ventilation controls. The nature of varying work sites makes exposure assessments challenging, but collecting short term samples during the 1-hour or so period in which the stripper is used, or estimating equilibrium concentrations based on amount of chemical dispensed in a given work room volume of air, would have alerted the employer to

hazardous conditions. Exposure monitoring would alert the employer to the need to establish regulated areas to protect others, and to make ventilation and respiratory controls mandatory whenever using the paint remover.

Adherence with the standard would have also provided guidance for clothing and gloves to protect exposed skin. The technician's work clothing did not provide coverage to her forearms; the latex gloves she wore were not chemically resistant to methylene chloride. Long gloves made of butyl rubber, polyethylene/ethylene vinyl alcohol (PE/EVAL, 4H™ and Silver Shield™ brand), or Teflon™ would protect the hands and forearms from contact with methylene chloride and methanol.

**Recommendation 6:** *Notify other individuals (non-employee occupants, neighbors, employees of other businesses working on site) working near or in locations where methylene chloride may be used of the hazards and of restricted regulated areas that cannot be entered.*

This recommendation is made to protect bystanders, neighboring occupants, maintenance workers, and first responders from unknowing exposure when methylene chloride products are being used. In this case, the apartment complex personnel had not received material safety data sheets or specific information on the resurfacing procedures and chemicals that were used. They were not warned prior to the incident that the apartment should be regarded as a regulated area, and that all apartment personnel and neighboring tenants should stay out of the work area. The apartment manager and first responders entered the apartment noting strong chemical odors from the open can of Klean-Strip AIRCRAFT® Low Odor Paint Remover that may have been open for as long as 4 to 5 hours, with up to 23 ounces spread on the bathtub surfaces. Signs and MSDS should be posted at the entrance to the work area alerting others of the restricted area and the chemicals used inside. This would protect against inhalation exposures and potential fire hazards from individuals who may be smoking or using other ignition sources nearby.

Responders and those entering an area where methylene chloride products are used should be equipped with respiratory protection and chemical-resistant clothing if there is potential for skin contact.

*Iowa FACE thanks the business owner and the Iowa Department of Labor for their time and assistance in developing this case report.*

**Keywords:** bathtub refinisher, paint stripper, methylene chloride, exposure

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<http://www.nrdc.org/health/files/methyleneChloride.pdf>

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<http://www.axispro.com/index.php?productID=7>

National Institute for Occupational Safety and Health National Personal Protective Technology Laboratory Certified Equipment List

[http://www2a.cdc.gov/drds/cel/cel\\_detail.asp?schedule=19C&approvalno=0320&manufacturercode=&cbrn\\_scba=&startrecord=1&maxrecords=50&sqlstmt=](http://www2a.cdc.gov/drds/cel/cel_detail.asp?schedule=19C&approvalno=0320&manufacturercode=&cbrn_scba=&startrecord=1&maxrecords=50&sqlstmt=)

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**Fatality Assessment and Control Evaluation**  
FACE

Fatality Assessment and Control Evaluation (FACE) is a program of the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention of the US Department of Health and Human Services. Nationally, the FACE program identifies traumatic work-related deaths, conducts in-depth studies of select cases, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. The Iowa FACE program is conducted by the Injury Prevention Research Center at the University of Iowa working in conjunction with the Iowa Department of Public Health and its Office of the State Medical Examiner.

NIOSH combines its and the state programs' information for wide dissemination, in a variety of forms, among the industries involved. NIOSH publications are available on the web at <http://www.cdc.gov/NIOSH/FACE/> and from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publications. In addition to postings on the national NIOSH website, the information is posted on the Iowa FACE website ([www.public-health.uiowa.edu/FACE/](http://www.public-health.uiowa.edu/FACE/)) and is also available by contacting Iowa FACE directly.

The Iowa FACE team at the University of Iowa includes Marizen Ramirez, Director; Corinne Peek-Asa, Co-Investigator; John Lundell, Co-Investigator; T. Renée Anthony, Co-Investigator; and Stephanie Leonard, Field Investigator. Additional expertise is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator; Kathy Leinenkugel, Surveillance Specialist; and John Kraemer, Director, Forensic Operations at Iowa Office of the State Medical Examiner.

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