

requirement was included to ensure that the employee and the employer have been informed of the above-mentioned results of the medical examination in a timely manner. This requirement differs slightly from that in proposed paragraph (i)(7)(i). Instead of the physician providing a copy of the written medical opinion to the employer, who then provides a copy to the employee, the final rule requires the physician or other licensed health care professional to supply a copy of the written medical opinion directly to both the employer and the employee. In addition, the time allowed for providing the opinion has been changed to recognize that time may be needed to receive and evaluate laboratory or other medical findings. The Agency believes that notifying both the employer and affected employees of the MC-related results of the medical surveillance at the same time is an efficient approach to disseminating this information to the appropriate parties. Providing copies of the same written opinion both to the employer and the employee ensures that the employer is aware of any factors that may influence work assignments or choice of personal protective equipment.

OSHA has added a requirement to the final rule that the physician or other licensed health care professional inform the employee of the carcinogenic and cardiac effects of MC to reinforce the information on MC's serious health effects that was transmitted during training. The Agency believes that this reinforcement will help to ensure that employees are aware of the potential effects of MC and take appropriate precautions when using this toxic substance.

OSHA received several comments on different aspects of paragraph (j)(9). For example, the UAW [Tr. 1884, 9/24/92] testified that the written opinion transmitted to the employer by the physician or other licensed health care professional should only state the limitations on the employee's exposure or use of respiratory or other personal protective equipment recommended by the physician or other health care professional, and should not include the medical or other reasons behind the recommended limitations.

OSHA agrees with the UAW that it is important to protect the privacy of employees enrolled in medical surveillance programs. Consequently, OSHA health standards have traditionally included a statement to the effect that no findings or diagnoses should be included in the physician's written opinion that are unrelated to occupational exposure. This requirement is intended both to protect

the employee's privacy and to encourage employees to participate in the employer's medical surveillance program. The restriction on what may be revealed in the written opinion appears in the final rule as paragraph (j)(9)(ii), and is intended to apply to all of the information provided in the physician's or other licensed health care professional's written opinion, including that related to recommended limitations.

The MVMA [Ex. 19-42] and ORC [Ex. 19-57] stated that the proposed 15-day requirement for providing the employer with a copy of the written opinion should be 15 days from the physician's or other licensed health care professional's receipt of the test results rather than 15 days from the date of the examination. The Agency agrees and, as described above, has changed the requirement so that the written opinion must be provided within 15 days of completion of evaluation of medical findings, but not more than 30 days after the examination. OSHA believes that this strikes the proper balance between allowing sufficient time for the physician or other licensed health care professional to evaluate any laboratory findings while still providing the information to the employer and the employee in a timely manner.

Newport News Shipbuilding [Ex. 19-37] and the Shipbuilders Council of America [Ex. 19-56] stated that the written opinion should require only that employees be notified of abnormal test results, not normal results. In response to these comments, OSHA notes that such a provision would actually require many physicians and other licensed health care professionals to change their current practice because it would require them specifically to delete normal results from printouts of laboratory and other findings. Such reports routinely display all results, both normal and abnormal, for a given individual. In addition, OSHA believes that employees benefit from knowing which of their blood parameters and other test results are normal and which are abnormal. OSHA does not believe that requiring medical personnel to increase the amount of paperwork they perform is a good use of medical resources, and has therefore not revised the final rule to respond to these comments.

Under paragraph (j)(9)(ii) of the final rule, the physician or other licensed health care professional must exclude findings or diagnoses that are unrelated to MC exposure from the written opinion provided to the employer. As discussed above, OSHA has included this provision in the final rule to

reassure employees participating in medical surveillance that they will not be penalized or embarrassed by the employer's obtaining information about them that is not directly pertinent to MC exposure. The above provisions are identical to those in proposed paragraph (i)(7)(ii). A note has been added to the final rule that states that the written opinion developed to comply with the MC standard may also contain information related to other OSHA standards. For example, an employer whose employees are enrolled in medical surveillance due to their exposure to benzene, formaldehyde and MC could receive a single, consolidated written opinion that addressed findings related to all three substances. This performance-oriented provision could result in reduced paperwork burdens for employers.

NPRM Issue 3 solicited input regarding whether the Agency should add a provision for Medical Removal Protection (MRP). Medical removal protection encourages employee participation in (and therefore increases the effectiveness of) the medical surveillance program by ensuring that reporting symptoms or health conditions to the physician or licensed health care professional will not result in loss of job or pay. Several rulemaking participants expressed support for the inclusion of MRP in the final rule [Exs. 19-23, 19-38; Tr. 1787, 9/24/92; Tr. 1802, 9/24/92; Tr. 1869, 9/24/92; and Tr. 1883, 9/24/92]. For example, the Amalgamated Clothing and Textile Workers (ACTWU) [Tr. 1793, 9/24/92] testified that OSHA should require MRP based on clinical judgment, as OSHA allowed in the final rule for formaldehyde (29 CFR 1910.1048). They also stated that they believed it was critical to have a medical removal protection provision in the MC standard in order to ensure worker participation. Mr. Frumin of the ACTWU testified as follows [Tr. 1792-1793, 9/24/92]:

As I say, the problems that employers, physicians and, for that matter, OSHA confront in trying to assure the integrity of medical surveillance programs are not limited to a particular substance. They deal with the general perception—these problems arise from the general perception of workers, which is widespread through industry, that if they submit to a medical examination and it's not confidential, and employers could get the results of the medical findings, that health problems may result in some negative action.

You have a symptom-based medical surveillance program, at least for the non-cancer effects. And if workers are supposed to report the types of symptoms, for instance, that Dr. Soden was looking for, shortness of breath, things of that nature—and they're

concerned that reporting that might involve some negative action against them: either their job security or their pay. You know, they will be discouraged from participating in medical surveillance, and the whole structure of the program is undermined. So the fact that these health effects are symptom-based rather than, say, based on laboratory tests alone, makes it all the more important to include medical removal protection and multiple physician review in the final rule.

Two commenters [Exs. 19–23, 19–38] suggested that MRP should be based on COHb levels. However, Dr. Mirer of the UAW [Tr. 1940, 9/24/92] disagreed with this idea and concurred with Mr. Frumin's remarks that medical removal protection should be based on symptoms and professional discretion. He stated,

* * * the guidance for the physicians, once the physician decides this employee is at increased risk, if they continue in this exposure and I want to remove him or her from the job, that's the trigger. At this moment, I would leave it that way. Increased carboxyhemoglobin is more an index of exposure than an adverse clinical effect, so I don't have any particular guidance. If the doctor wants to pull that man or woman out of a job, that's where I am now.

He continued,

* * * the other benefit of protecting the disclosure of symptoms is that it's going to identify sources of exposure, because one of the ways of determining exposure is by the presentation of symptoms. So the benefit of having them disclose symptoms is it will lead to lower exposure.

I can't think of anything much else that you would need to get out of MRP than improved participation, although at least our experience in lead is that MRP has been the driving force to reduce exposures independent of that.

OSHA considered the issues raised during the MC rulemaking and in general agrees with these worker representatives that MRP increases employee participation in medical surveillance. OSHA remains concerned about several issues, however. The Agency recognizes that employees may hesitate to participate in medical surveillance if they have reason to expect that the results may adversely affect them economically. However, OSHA has determined that there is no substantive guidance that it could give a physician or other licensed health care professional to indicate when it might be appropriate to remove an employee temporarily from the workplace, or what an appropriate trigger for return to work might be. Accordingly, OSHA has decided to promulgate the final rule for MC without including MRP provisions. The Agency will continue to monitor compliance with the medical

surveillance and PPE provisions of this standard and the experience in industries subject to standards with medical removal protection provisions to determine whether any further action is warranted.

Paragraph (k) Hazard Communication

The requirements for hazard communication have been changed from proposed paragraph (j) (Communication of MC hazards to employees) and promulgated in paragraph (k) of the final rule. The paragraph addressing hazard communication in the final MC rule is consistent with the requirements of OSHA's Hazard Communication Standard (HCS). The HCS requires all chemical manufacturers and importers to assess the hazards of the chemicals they produce or import. It also requires all employers to provide information concerning the hazards of such chemicals to their employees. The transmittal of hazard information to employees is to be accomplished by such means as container labeling and other forms of warning, material safety data sheets and employee training.

Since the HCS "is intended to address comprehensively the issue of evaluating the potential hazard of chemicals and communicating information concerning hazards and appropriate protective measures to employees" (52 FR 31877), OSHA is including paragraph (k) in the final rule only to reference the HCS requirements for labels and material safety data sheets, and to indicate specifically the MC health effects that are required to be addressed under that rule. This additional guidance to employers simply reiterates the requirements of the HCS to convey information to affected employees about all health hazards to which they are potentially exposed. The health effects addressed by the final MC rule are cancer, cardiac effects (including elevation of carboxyhemoglobin), central nervous system effects, and skin and eye irritation. There may also be other health hazards or physical hazards associated with MC that meet the definitions of coverage under the HCS. These should be addressed appropriately on the label and MSDS as well.

Employers who have already met their longstanding requirements to comply with the HCS will have no additional duties with regard to labels and MSDSs under the MC final rule. This is consistent with the suggestions of some commenters that no requirements should be mandated beyond those listed in the HCS [Exs. 19–25, 19–31, 19–42]. OSHA agrees that the HCS addresses the issue

comprehensively, and additional requirements are not necessary to protect MC-exposed employees specifically. As a result, the Agency has deleted the proposed requirement for warning signs. Such signs are not required under the HCS, although they may be useful in some situations and employers may choose to use them. The Organization Resources Counselors [Ex. 19–57] commented that the required signs should say "warning" and not "danger" as proposed, and suggested consistency with the benzene and ethylene oxide standards. It should be noted that the terms "warning" and "danger" have specific meaning in the context of labels, and there are criteria for their application under voluntary consensus standards such as the ANSI Z129.1 standard for precautionary labeling. ORC's comment is otherwise moot at this point since the relevant requirement has been deleted.

Paragraph (l) Employee Information and Training

The requirements for employee information and training, which were part of proposed paragraph (j) (Communication of MC hazards to employees), have been separated from the hazard communication requirements for labels and data sheets described above, and promulgated as paragraph (l) in the final MC rule. Some of the training provisions that were proposed duplicated requirements of the HCS. These have been removed, and a reference to the information and training required under the HCS has been added to simply remind employers of their longstanding obligations under that rule to ensure that employees are apprised of the hazards of the chemicals in their workplaces, as well as appropriate protective measures. The information and training requirements in the final MC rule build upon those requirements with additional information specific to MC that will help employees understand the risks of exposure and the means to prevent adverse health effects from occurring in their particular workplaces.

It should be noted that the information and training requirements in the final rule have been separated from each other rather than being addressed together, because they deal with different ways of conveying information. "Information" transmittal is simply that—a passive process of making information available to employees should they choose to use it. In some cases, this may be done in writing or some other simple manner of information transfer. "Training," on the other hand, is not a passive process. The

information provided to employees in training requires them to comprehend it and subsequently to use it in the performance of their duties in the workplace. There are many different ways to accomplish training effectively, but it cannot be a simple transfer of information such as handing someone a written document. OSHA's voluntary training guidelines, which are found in OSHA Publication No. 2252, are available to provide employers additional guidance in setting up and implementing an appropriate employee training program. An effective training program is a critical component of any safety and health program in the workplace. Workers who are fully informed and engaged in the protective measures established by the employer will play a significant role in the prevention of adverse health effects. Ineffective training will not serve the purpose of making workers full participants in the program, and the likelihood of a successful program for safety and health in the absence of an effectively trained workforce is remote.

Paragraph (l)(1) requires employers to provide all employees who are potentially exposed to MC with information and training on MC prior to or at the time of initial assignment to a job involving MC exposure. Thus employees will have the information they need to protect themselves before they are actually subject to exposure. The final rule further indicates in paragraph (l)(2) that employers shall ensure that the information and training is presented in a manner that is understandable to employees and that employees have received the information and training required under the HCS.

Paragraph (l)(3) addresses the information to be provided to affected employees. This includes the requirements of the final MC standard and information available in its appendices, as well as how the employee can access or obtain a copy of it in the workplace. This will ensure that MC-exposed employees are aware that specific requirements have been established to protect them from adverse health effects, and give them an opportunity to review those requirements themselves if they so desire. Wherever employee exposures exceed or can reasonably be expected to exceed the action level, the employer is required to inform employees about the location of MC in the workplace, what operations may be affected, particularly noting where in the workplace there may be exposures above the permissible exposure limits.

Paragraph (l)(4) requires each employer to train each affected employee as required under the Hazard Communication Standard (29 CFR 1910.1200, 29 CFR 1915.1200 or 29 CFR 1926.59, as appropriate). This provision simply reminds employers of their obligation to train employees regarding the hazards of MC under the Hazard Communication Standard.

The final rule does not provide a specific time period for updating the training, whereas the proposed standard included a requirement for annual retraining. Instead, the final rule indicates in paragraph (l)(5) that the employer shall re-train each affected employee as necessary to ensure that employees exposed above the action level or the STEL maintain a good understanding of the principles of safe use and handling of MC in the workplace. Employers can assess whether this understanding is generally present in exposed employees in various ways, such as by observing their actions in the workplace. For example, if an employee is not using appropriate protective equipment or following safe work practices routinely, this may be an indication that additional training is required. This provision of the final rule is a performance-oriented requirement that allows each employer to determine how much or how often training is needed.

Paragraph (l)(6) requires that the employer do additional training when the workplace is modified or changed in such a way that employees are subject to greater exposures and those exposures exceed or can reasonably be expected to exceed the action level and those employees need information and training to understand how to implement the modifications or training successfully. This provision was not in the proposal, but the Agency considers it necessary to further protect employees from the hazards of MC when significant changes in workplace conditions occur.

Paragraph (l)(7) requires the employer whose employees are exposed to MC at a multi-employer worksite to notify the other employers with work operations at that site regarding the use of MC-containing materials, the hazards associated with the use of those materials and the control measures implemented to protect affected employees from MC exposure, in accordance with the requirements of the Hazard Communication Standard (HCS). The HCS addresses sharing information at multi-employer worksites, and since this final rule covers construction where most of the sites are multi-employer, this provision was added to remind

such employers of these requirements. OSHA is also aware that an increasing number of manufacturing worksites involve more than one employer.

In paragraph (l)(8) of the final rule, OSHA has indicated that the Assistant Secretary or the Director may access all materials relating to employee information and training in the workplace. This would be done in conjunction with an inspection to ascertain compliance with the rule, or in the event of a NIOSH health hazard evaluation. Review of the available materials regarding information and training will help assess whether the program has been properly conducted, as well as evaluate what could be improved if employees do not appear to be effectively trained.

The information and training provisions of this standard are performance-oriented, because employees are exposed to MC in a wide variety of circumstances and the best method of conveying the necessary data may vary from site-to-site. The standard lists the categories of information to be transmitted to employees but does not specify the ways in which it is to be transmitted.

Some commenters [Tr. 531-32, 9/18/92; Tr. 545-49, 9/18/92; Tr. 828-32, 9/21/92; Tr. 1380, 1384-85, 9/23/92] suggested that OSHA make the proposed training provisions more specific, such as by including requirements for length of training, qualifications of instructors, or requirements for interactive training. In addition, hearing participants and commenters suggested that OSHA require employers to monitor the effectiveness of training [Ex. 19-38, Tr. 531-32, 9/18/92]. These participants suggested that provisions be made, as well, for training of workers in languages other than English and for training of workers with limited literacy [Ex. 19-38, Tr. 531-32, 9/18/92; Tr. 831-32, 9/21/92].

The International Brotherhood of Painters and Allied Trades, AFL-CIO, testified [Tr. 830-831, 9/21/92]:

We urge OSHA to promulgate a standard that requires that workers receive a minimum of 16 hours training. Such training would include at the minimum information on the hazards of methylene chloride and how it harms the body. Engineering controls that can be implemented in the field should be described and demonstrated. We will submit information on one such control to the record. Training should also include information on work practices associated with specific job assignments, methods by which workers can protect themselves, the limits of respirators use, appropriate procedures for work in confined spaces, employee rights under the standard, the

purpose of medical surveillance and other elements of training as enumerated in Section (j)(4).

OSHA does not agree that specifying a time frame for training ensures that it will be complete, appropriate, or effective. The amount of training required will depend to a large extent on the conditions of use in a given workplace. It will also be related to the extent of training on MC that has already been done by the employer under the HCS. Therefore, the final rule provisions remain performance-oriented with regard to the time needed to convey the information and training.

With regard to the issues of literacy and language, these remain a significant consideration in the proper design and implementation of any training program. Because working safely with MC is such a significant concern, the employer must make every effort to ensure that the training is presented in such a way that employees can understand and act on the information.

OSHA expects that employers will ensure that the information and training is effective. Any good training program should include an evaluation component to help ensure effectiveness. The voluntary training guidelines previously recommended can provide additional guidance in this respect.

OSHA received comments that indicated that the MC standard should simply refer to the HCS rather than having separate requirements [Exs. 19–25; 19–49]. While the Agency agrees with these comments in reference to the label and MSDS requirements, it does not appear that this is the appropriate approach to training. While the HCS addresses training about the hazards of a chemical and appropriate precautionary measures, there are other items of training that are specific to the MC standard requirements and the determinations made in this rulemaking regarding MC. As such, it is important to ensure that the already-required HCS training is supplemented with information and training specific to MC.

Paragraph (m) Recordkeeping

Paragraph (m) of the final rule addresses requirements for employers to create and maintain records of their compliance with some of the provisions of this section. Section 8(c)(1) of the OSH Act authorizes the Agency to promulgate regulations requiring employers to keep necessary and appropriate records regarding activities to permit the enforcement of the Act or to develop information regarding the causes and prevention of occupational accidents and illnesses. Section 8(c)(3) of the Act specifically addresses the

promulgation of “regulations requiring employers to maintain accurate records of employee exposures to potentially toxic materials or harmful physical agents which are required to be monitored or measured under section 6.”

Paragraph (m)(1) requires that employers who rely on objective data to characterize potential exposures to MC, rather than conducting initial monitoring under paragraph (d) of this section, maintain records that show the information and methodology used in reaching their conclusion that exposures are at or below the action level and no additional monitoring is required. The record must include the MC-containing material evaluated; the source of the objective data; the testing protocol, and the results or analysis of the testing; a description of the operation(s) exempted from monitoring, and how the data support the exemption; and other relevant data.

Since the use of objective data exempts the employer from conducting monitoring, as well as establishing that most of the other provisions need not be complied with due to the low level of potential exposure, it is critical that this determination be carefully documented. Compliance with the requirement to maintain a record of objective data protects the employer at later dates from the contention that initial monitoring was improperly omitted. The record will also be available to employees so that they can examine the determination made by the employer. The employer is required to maintain the record for the duration of the employer's reliance upon objective data. This provision is effectively identical to proposed paragraph (k)(1).

Paragraph (m)(2) requires that employers establish and keep an accurate record of all measurements taken to monitor employee exposure to MC. For employers with 20 or more employees, the record must include at least: the date of measurement for each sample taken; the operation involving exposure to MC which is being monitored; sampling and analytical methods used and evidence of their accuracy; number, duration and results of samples taken; the type of personal protective equipment, such as respiratory protective devices worn (if any); and name, social security number, and job classification and exposure of all the employees deemed to be represented by such monitoring, indicating which employees were actually monitored. For employers with fewer than 20 employees, the record shall include, at a minimum: the date of measurement for each sample; the

number, duration and results of samples taken; and name, social security number, job classification and exposure of all the employees deemed to be represented by such monitoring, indicating which employees were actually monitored. OSHA believes it is necessary to maintain these records so that employers, employees and OSHA can determine the extent to which MC exposure has been identified and subsequently controlled. Over time, the exposure records can help determine if additional measures are needed for employee protection. OSHA has reduced the amount of information required for small businesses in recognition of the more limited variety of operations and exposure levels there. This should ease these employers' recordkeeping burden without compromising employee safety and health in these types of facilities.

Two commenters [Exs. 19–25, 19–49] suggested that such documentation should only be required for each person actually monitored (paragraph (d)(1) provides for representative monitoring). However, OSHA believes that it is necessary for records to be kept for each employee represented by the exposure monitoring so that individual employees can access information that characterizes their own exposures to MC. If records were kept only for those actually monitored, it would be unreasonably difficult for an employee to identify the exposure measurement that is intended to represent his or her experience. Accordingly, OSHA has not made the suggested change.

Paragraph (m)(3) requires that the employer keep accurate medical records for each employee subject to medical surveillance. The information to be included in the record addresses identification of the employee; the physician's or other licensed health care professional's written opinions; and documentation of any employee medical conditions that are found to be related to MC exposure. Maintenance of employee medical records is necessary for the proper evaluation of the employee's health, as well as for appropriate followup.

Proposed paragraph (k)(3)(ii)(D) required that a copy of the information provided to the physician or other licensed health care professional be included in the employee record. The Dow Chemical Company [Ex. 19–31] requested that, because many larger companies have company medical facilities, some provision be made so that records do not have to be maintained in medical department records and duplicated in the personnel record of every employee potentially

exposed to MC. The information required under paragraph (j)(8) of this section includes a copy of this section including its appendices, a description of duties involving MC exposure, exposure levels, personal protective equipment, and previous medical surveillance information. Since this information is available to the employee through other means, OSHA believes that the requirements under proposed paragraph (k)(3)(ii)(D) were unnecessarily burdensome, and OSHA has therefore deleted this paragraph from the final rule. OSHA has also deleted proposed requirements for maintaining records of employee fit testing as being unnecessarily burdensome. Dow also suggested that an employee identification number be permitted in lieu of social security number [Ex. 19-31]. OSHA does not agree with this suggestion. Social security numbers have much wider application, and are correlated to employee identity in other types of records. These numbers are a more useful differentiation among employees since each number is unique to an individual for a lifetime and does not change as an employee changes employers.

Paragraph (m)(4) of the final rule specifies that access to exposure and medical records by employees, employees' designated representatives, NIOSH and OSHA shall be provided in accordance with 29 CFR 1910.1020. OSHA promulgated 29 CFR 1910.1020 as the generic rule for access to employee exposure and medical records on May 23, 1980 (45 FR 35212). It applies to records created under specific OSHA standards and to records that are voluntarily created by employers. OSHA retains unrestricted access to medical and exposure records but its access to personally identifiable records is subject to the Agency's rules of practice and procedure concerning OSHA access to employee medical records, which have been published at 29 CFR 1913.10.

The time periods required for retention of exposure records and medical records is thirty years and the period of employment plus thirty years, respectively. These retention requirements are consistent with those in the OSHA records access standard and with pertinent sections of the Toxic Substances Control Act. It is necessary to keep records for extended periods of time because of the long latency periods commonly observed for the induction of cancer caused by exposures to carcinogens. Cancer often cannot be detected until 20 or more years after onset of exposure. The extended record retention period is therefore needed for

two purposes. First, possession of past and present exposure data and medical records furthers the diagnosis of workers' ailments. In addition, retaining records for extended periods makes possible a review at some future date of the effectiveness and adequacy of the standard.

Paragraph (m)(5) requires employers to comply with the requirements of 29 CFR 1910.1020(h). That provision requires the employer to notify the Director of NIOSH in writing at least 90 days prior to the disposal of records and to transfer those records to NIOSH unless told not to do so by NIOSH. The employer is required to comply with any other applicable requirements set forth in the records retention standard.

Paragraph (n) Dates

This paragraph establishes the effective date for the MC final rule, and the start-up dates for the various provisions of the standard. The start-up dates allow employers additional time to comply with some of the provisions of the standard that require more effort to accomplish. It is expected that such work will commence by the effective date, and be completed as soon as possible but in no case later than the compliance deadline established by the effective date. All other obligations imposed by the standard become effective on the effective date unless otherwise indicated.

Paragraph (n)(1) of the final rule provides that this standard will become effective on April 10, 1997. This date is 90 days from the date of publication in the Federal Register. Proposed paragraph (m)(1) had provided that the final rule would become effective 60 days after publication in the Federal Register. OSHA stated in the preamble to the proposed rule [56 FR 57128] that the proposed effective date, in conjunction with the proposed start-up dates, would allow sufficient time for employers to achieve compliance with the substantive requirements of the proposed rule.

Although no commenters directly addressed the 60-day period proposed in paragraph (m)(1), several commenters addressed the reasonableness of the start-up dates in proposed paragraph (m)(2). Those comments, discussed below, indicated that some employers would need more time to comply than the proposed rule would have allowed.

The Agency sets the effective date to allow sufficient time for employers to obtain the standard, read and understand its requirements, and undertake the necessary planning and preparation for compliance. Section 6(b)(4) of the OSHA Act provides that

the effective date of an OSHA standard may be delayed for up to 90 days from the date of publication in the Federal Register. Given the concerns expressed by commenters, OSHA's interest in having employers implement effective compliance efforts, and the minimal effect of the additional 30 day delay, the Agency has decided that it is appropriate to set the effective date at 90 days from publication, rather than at 60 days.

Paragraph (n)(2) of the final rule establishes the start-up dates for compliance with the provisions of the MC standard. The start-up dates are based on information in the record about the state of the art with regard to the types of provisions employers are expected to implement, such as available control measures, their complexity, and the time that is reasonably necessary to complete their installation and implementation. In the case of MC, the types of provisions included in the rule, such as requirements that will require conventional controls, are identical to the elements included in all OSHA health standards.

Proposed paragraphs (m)(2)(i), (ii) and (iii) required that initial monitoring be completed by all employers within 120 days of the effective date of the MC standard, engineering controls within one year of the effective date and all other requirements within 180 days of the effective date. As described below, OSHA received numerous comments on the appropriateness of the start-up dates, especially for small businesses. Given the large number of small employers covered by the requirements, and the special problems of many of those employers in identifying and implementing appropriate control measures, OSHA has decided to phase-in compliance and to permit these employers a longer time period in which to comply with the requirements of the standard. The schedule for compliance with the provisions of the standard are described below.

OSHA received a number of comments on the proposed periods for compliance with the control requirements. In 1992, Kodak [Exs. 19-18 and 19-102] described circumstances at its film base production facility that would prevent compliance with the PELs through engineering controls before mid-1995. Kodak stated "[it] is essential that OSHA be responsive to these considerations in promulgating the final rule. OSHA should permit adequate time for Kodak to implement feasible engineering controls in an orderly and minimally disruptive schedule." Considering the effective

date and start-up dates in this regulation, OSHA has determined that affected parties will have sufficient time to comply with the standard.

Similar requests for longer time periods for compliance were also received from a variety of other commenters [Exs. 19-55, 19-57, 19-67, 19-72, 19-75, 115-3, 115-28, 115-33, 115-37, Tr. 1422, 1427-29, 9/23/92, Tr. 2103, 10/14/92, Tr. 2291-92, 2300, 10/15/92]. However, OSHA's Final Economic Analysis for this rulemaking indicates that readily available control measures can be used to control exposure in many of the operations where MC is present. In general, compliance will not require the development of new or novel control technology. Accordingly, OSHA believes that more extended time periods for compliance are not necessary for all affected industries. However, as discussed below, small businesses (for example, those with fewer than 20 employees and polyurethane foam manufacturers with 20 to 99 employees) have been granted additional time to comply.

As discussed above in Section VIII, several commenters [Exs. 19-14, 19-25, 19-28 and 19-29] stated that engineering controls to achieve compliance were not available. These commenters further stated that the development and implementation of the process changes and engineering controls needed to achieve compliance would take four years from the effective date, not the single year proposed. For example, the Pharmaceutical Manufacturers Association and Abbott Laboratories [Exs. 19-25 and 19-29] stated as follows:

[I]f the agency should rule that the exposure level to MC be reduced to 25 ppm for an 8-hour TWA and a 125 ppm STEL, a minimum of 1 year from the effective date must be allowed for identification of the engineering controls. A minimum of 3 years from the effective date must be allowed for compliance with paragraph (f)(1) of the proposed rule.

Those commenters and the HSIA [Ex. 19-45] also indicated that FDA approval is needed in the pharmaceutical industry for any alteration of manufacturing processes, substitution for MC, or modification of work practices to achieve compliance with OSHA's MC standard, and requested that OSHA consider the FDA's regulatory requirements when establishing start-up dates. In particular, Abbott Laboratories described how it took three years to obtain FDA approval for the substitution of hydroalcoholic or aqueous solutions for MC in tablet coating operations, stating "[p]resently,

completion of required testing and obtaining FDA approval for production of a single product can take 3 months to three years, depending upon the extent of the change."

Abbott also commented as follows [Ex. 19-29]:

As stated previously, feasible engineering controls do not exist for the present bulk pharmaceutical centrifugal separation and drying equipment. Implementation of engineering controls would therefore require the use of a different process or a different production method. Changes of that degree require Abbott Laboratories to complete development work on an alternative process and/or identify new production equipment; erect a building to house the equipment; purchase, receive and install the equipment; train employees; and validate the process. This cannot be accomplished in one year.

OSHA is aware that pharmaceutical manufacturers must comply with other regulatory requirements, including those set by the FDA. The Agency has considered how affected employers, in general, need to coordinate their OSHA compliance efforts with their other regulatory compliance activities, that this regulation does not require implementation of particularly complicated or novel control technologies, and that the compliance time frames are in keeping with those in other OSHA standards. OSHA views the coordination of OSHA compliance with other regulatory compliance activities as an ongoing employer effort, not just an ad hoc response to a particular OSHA action (such as the revision of a PEL). For example, a pharmaceutical manufacturer would need to consider the implications for OSHA compliance of process changes undertaken due to FDA requirements or for other reasons, whether those changes were to be made during the MC standard's "start-up" period or subsequently.

Accordingly, the Agency has determined that the commenters have not established a need for the requested extension of the start-up dates. OSHA believes that the proposed one-year period in which to implement controls will, in general, be adequate and, therefore, has not made the suggested change. However, as discussed elsewhere, OSHA has tailored the compliance schedule to the size of the establishment and anticipated impact of the standard on those businesses.

Dow [Ex. 19-31] also expressed concern that many employers would be unable to meet the start-up dates, focusing on the time and resources that would be required to conduct initial monitoring. In addition, Dow stated as follows "OSHA should require that certain actions be completed within the

stated time periods and that if the actions can not be completed, the employer should have a written plan and corresponding actions to show a good faith effort to meet the requirements." OSHA agrees that there may be circumstances where, despite good faith efforts, employers cannot achieve compliance within the time periods specified by paragraph (n)(2). OSHA further agrees that developing a written plan and taking other "good faith" actions towards compliance would be appropriate measures to mitigate any circumstances of non-compliance with the regulation. Indeed, the suggested procedure closely resembles the temporary variance process already established by OSHA.

Under section 6(b)(6) of the OSH Act, an employer can obtain a temporary variance from compliance with an OSHA standard if it shows that it cannot achieve compliance by the effective date; is taking all available steps to safeguard its employees from the pertinent hazard; and has an effective program for coming into compliance with the standard. The implementing regulations for the temporary variance process appear at 29 CFR part 1905. Employers who experience difficulties in meeting the start-up dates should contact OSHA and apply for a temporary variance.

The HSIA [Ex. 19-45] recommended that OSHA "provide a compliance schedule similar to that provided in the generic PEL update * * * [which] in some circumstances allows employers until December 31, 1993 to comply (a total of 4 years and 10 months)." In addition to mentioning the lengthy FDA approval process, the HSIA noted that "DCM users, particularly many of the smaller companies, will find compliance technologically and economically difficult at best."

As stated above, OSHA believes that the sort of extended compliance schedule set through the generic PEL update is unnecessary for the MC standard. Based on its review of the rulemaking record, the Agency has reached the general conclusion that employers will be able to achieve compliance within the time frames established in paragraph (n).

However, OSHA is concerned that some small facilities affected by this rulemaking, such as many of those in the furniture refinishing industry and the polyurethane foam manufacturing industry, may have difficulties determining the appropriate control measures to use and also may not be able to absorb the costs of compliance, particularly those associated with implementing the appropriate

engineering controls within the time frames initially proposed. The Agency has estimated (see Section VIII, Summary of the Final Economic Analysis) that allowing a variable

schedule of compliance, based upon size of establishment, will enable firms in all impacted sectors to absorb many of the compliance costs without endangering their financial health.

Based on these considerations, OSHA has determined that the following implementation schedule is reasonable and appropriate for businesses of all sizes:

Establishment size	Initial monitoring provisions must be complied with within	Implementation of engineering controls must be completed within	All other provisions must be complied with within
Fewer than 20 employees	300 days of the effective date	3 years of the effective date	1 year of the effective date.
Polyurethane foam manufacturers with 20 to 99 employees.	210 days of the effective date	2 years of the effective date	270 days of the effective date.
All other employers	120 days of the effective date	1 year of the effective date	180 days of the effective date.

The Agency is promulgating paragraph (n) accordingly.

The schedule of intermediate start-up dates (210 d, 270 d and 2 years) for polyurethane foam manufacturers with 20 to 99 employees was limited to this application group because this group has the highest potential economic impacts except for the furniture stripping and construction groups. In both of the latter groups, most firms have fewer than 20 employees, and thus would already be allowed additional time to comply with the final rule's start-up dates. In contrast, in the flexible polyurethane foam manufacturing group, even firms with fewer than 100 employees will need to install several types of engineering controls and are likely to have unusually high capital expenditures in order to meet the requirements of the regulation. This extension of compliance deadlines will allow those firms that need extensive engineering controls time to adequately plan for and implement their system of controls. This modification will thus also help to ensure adequate protection for workers.

Paragraph (o) Appendices

The final paragraph of the standard simply states that the appendices which follow are not intended to create any additional obligations beyond those already specified in the standard. They are basically intended as non-mandatory guidance documents to supplement and complement the regulatory requirements in the standard, and to provide additional information about MC and its safe handling and use to exposed employees, employers, and health care professionals.

A few comments were received by OSHA regarding the text of the appendices as proposed. These addressed the need for additional information [Ex. 57, Tr. 832, 9/21/92, Tr. 1380 and 1384-85, 9/23/92], or whether information should appear in an appendix or in the regulatory text

itself [see, e.g., Tr. 2435-36 and 2448-49, 10/15/92]. OSHA has reviewed and updated the text in the appendices to address these comments and ensure that they are consistent with the new regulatory text in the final standard.

Also, proposed Non-mandatory Appendix C, which addressed respirator fit testing, has not been included in the final rule, because OSHA has determined that very few of the respirators used to comply with this standard will require fit testing. In addition, OSHA's revision of the generic respirator standard (29 CFR 1910.134) will contain an up-to-date appendix that addresses fit testing for all respirators.

XI. Authority and Signature

This document was prepared under the direction of Joseph A. Dear, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210.

Pursuant to sections 4, 6(b), 8(c) and 8(g) of the Occupational Safety and Health Act (29 U.S.C. 653, 655, 657), section 107 of the Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); the Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); the Secretary of Labor's Order No. 1-90 (55 FR 9033); and 29 CFR part 1911; 29 CFR parts 1910, 1915 and 1926 are amended as set forth below.

List of Subjects in 29 CFR Part 1910, 1915 and 1926

Chemicals, Cancer, Health risk-assessment, Methylene chloride, Occupational safety and health.

Signed at Washington, D.C., this 31st day of December 1996.

Joseph A. Dear,
Assistant Secretary of Labor.

XII. Final Standard Regulatory Text

Parts 1910, 1915, and 1926 of Title 29 of the Code of Federal Regulations are amended as follows:

PART 1910—[AMENDED]

Subpart B—[Amended]

1. The authority citation for subpart B of part 1910 continues to read as follows:

Authority: Secs. 4, 6 and 8 of the Occupational Safety and Health Act, 29 U.S.C. 653, 655, 657; Walsh-Healey Act, 29 U.S.C. 35 *et seq*; Service Contract Act of 1965, 41 U.S.C. 351 *et seq*; Contract Work Hours and Safety Standards Act (Construction Safety Act), 40 U.S.C. 333; Sec 41 Longshore and Harbor Worker's Compensation Act, 33 U.S.C. 941; National Foundation on Arts and Humanities, 20 U.S.C. 951 *et seq*; Secretary of Labor's Order No. 12-71 (36 FR 8754); 8-76 (41 FR 25059); 9-83 (48 FR 35736); 1-90 (55 FR 9033); and 29 CFR part 1911.

2. By adding a new paragraph (m) to §1910.19 to read as follows:

§ 1910.19 Special provisions for air contaminants.

* * * * *

(m) *Methylene Chloride (MC)*: Section 1910.1052 shall apply to the exposure of every employee to MC in every employment and place of employment covered by §1910.16 in lieu of any different standard on exposure to MC which would otherwise be applicable by virtue of that section when it is not present in sealed, intact containers.

Subpart Z—[Amended]

3. The authority citation for subpart Z of 29 CFR part 1910 continues to read, in part, as follows:

Authority: Secs. 6 and 8 Occupational Safety and Health Act, 29 U.S.C. 655, 657; Secretary of Labor's Orders 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033), as applicable; and 29 CFR part 1911.

* * * * *

§ 1910.1000 [Amended]

4. By removing the entire entry for Methylene Chloride (Z37.23-1969) in Table Z-2 of § 1910.1000 and adding the

following entry in its place in the substance column: "Methylene chloride: see § 1910.1052".

5. By adding a new § 1910.1052 to read as follows:

§ 1910.1052 Methylene Chloride.

This occupational health standard establishes requirements for employers to control occupational exposure to methylene chloride (MC). Employees exposed to MC are at increased risk of developing cancer, adverse effects on the heart, central nervous system and liver, and skin or eye irritation. Exposure may occur through inhalation, by absorption through the skin, or through contact with the skin. MC is a solvent which is used in many different types of work activities, such as paint stripping, polyurethane foam manufacturing, and cleaning and degreasing. Under the requirements of paragraph (d) of this section, each covered employer must make an initial determination of each employee's exposure to MC. If the employer determines that employees are exposed below the action level, the only other provisions of this section that apply are that a record must be made of the determination, the employees must receive information and training under paragraph (l) of this section and, where appropriate, employees must be protected from contact with liquid MC under paragraph (h) of this section. The provisions of the MC standard are as follows:

(a) *Scope and application.* This section applies to all occupational exposures to methylene chloride (MC), Chemical Abstracts Service Registry Number 75-09-2, in general industry, construction and shipyard employment.

(b) *Definitions.* For the purposes of this section, the following definitions shall apply:

Action level means a concentration of airborne MC of 12.5 parts per million (ppm) calculated as an eight (8)-hour time-weighted average (TWA).

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Authorized person means any person specifically authorized by the employer and required by work duties to be present in regulated areas, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under paragraph (d) of this section, or any other person authorized by the OSH Act or regulations issued under the Act.

Director means the Director of the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Emergency means any occurrence, such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which results, or is likely to result in an uncontrolled release of MC. If an incidental release of MC can be controlled by employees such as maintenance personnel at the time of release and in accordance with the leak/spill provisions required by paragraph (f) of this section, it is not considered an emergency as defined by this standard.

Employee exposure means exposure to airborne MC which occurs or would occur if the employee were not using respiratory protection.

Methylene chloride (MC) means an organic compound with chemical formula, CH_2Cl_2 . Its Chemical Abstracts Service Registry Number is 75-09-2. Its molecular weight is 84.9 g/mole.

Physician or other licensed health care professional is an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (j) of this section.

Regulated area means an area, demarcated by the employer, where an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed either the 8-hour TWA PEL or the STEL.

Symptom means central nervous system effects such as headaches, disorientation, dizziness, fatigue, and decreased attention span; skin effects such as chapping, erythema, cracked skin, or skin burns; and cardiac effects such as chest pain or shortness of breath.

This section means this methylene chloride standard.

(c) *Permissible exposure limits (PELs).*

(1) *Eight-hour time-weighted average (TWA) PEL.* The employer shall ensure that no employee is exposed to an airborne concentration of MC in excess of twenty-five parts of MC per million parts of air (25 ppm) as an 8-hour TWA.

(2) *Short-term exposure limit (STEL).* The employer shall ensure that no employee is exposed to an airborne concentration of MC in excess of one hundred and twenty-five parts of MC per million parts of air (125 ppm) as determined over a sampling period of fifteen minutes.

(d) *Exposure monitoring.* (1) *Characterization of employee exposure.*

(i) Where MC is present in the workplace, the employer shall determine each employee's exposure by either:

(A) Taking a personal breathing zone air sample of each employee's exposure; or

(B) Taking personal breathing zone air samples that are representative of each employee's exposure.

(ii) *Representative samples.* The employer may consider personal breathing zone air samples to be representative of employee exposures when they are taken as follows:

(A) *8-hour TWA PEL.* The employer has taken one or more personal breathing zone air samples for at least one employee in each job classification in a work area during every work shift, and the employee sampled is expected to have the highest MC exposure.

(B) *Short-term exposure limits.* The employer has taken one or more personal breathing zone air samples which indicate the highest likely 15-minute exposures during such operations for at least one employee in each job classification in the work area during every work shift, and the employee sampled is expected to have the highest MC exposure.

(C) *Exception.* Personal breathing zone air samples taken during one work shift may be used to represent employee exposures on other work shifts where the employer can document that the tasks performed and conditions in the workplace are similar across shifts.

(iii) *Accuracy of monitoring.* The employer shall ensure that the methods used to perform exposure monitoring produce results that are accurate to a confidence level of 95 percent, and are:

(A) Within plus or minus 25 percent for airborne concentrations of MC above the 8-hour TWA PEL or the STEL; or

(B) Within plus or minus 35 percent for airborne concentrations of MC at or above the action level but at or below the 8-hour TWA PEL.

(2) *Initial determination.* Each employer whose employees are exposed to MC shall perform initial exposure monitoring to determine each affected employee's exposure, except under the following conditions:

(i) Where objective data demonstrate that MC cannot be released in the workplace in airborne concentrations at or above the action level or above the STEL. The objective data shall represent the highest MC exposures likely to occur under reasonably foreseeable conditions of processing, use, or handling. The employer shall document the objective data exemption as specified in paragraph (m) of this section;

- (ii) Where the employer has performed exposure monitoring within 12 months prior to April 10, 1997 and that exposure monitoring meets all other requirements of this section, and was conducted under conditions substantially equivalent to existing conditions; or
- (iii) Where employees are exposed to MC on fewer than 30 days per year (e.g.,

on a construction site), and the employer has measurements by direct-reading instruments which give immediate results (such as a detector tube) and which provide sufficient information regarding employee exposures to determine what control measures are necessary to reduce exposures to acceptable levels.

(3) *Periodic monitoring.* Where the initial determination shows employee exposures at or above the action level or above the STEL, the employer shall establish an exposure monitoring program for periodic monitoring of employee exposure to MC in accordance with Table 1:

Table 1.—SIX INITIAL DETERMINATION EXPOSURE SCENARIOS AND THEIR ASSOCIATED MONITORING FREQUENCIES

Exposure scenario	Required monitoring activity
Below the action level and at or below the STEL	No 8-hour TWA or STEL monitoring required.
Below the action level and above the STEL	No 8-hour TWA monitoring required; monitor STEL exposures every three months.
At or above the action level, at or below the TWA, and at or below the STEL.	Monitor 8-hour TWA exposures every six months.
At or above the action level, at or below the TWA, and above the STEL	Monitor 8-hour TWA exposures every six months and monitor STEL exposures every three months.
Above the TWA and at or below the STEL	Monitor 8-hour TWA exposures every three months.
Above the TWA and above the STEL	Monitor 8-hour TWA exposures and STEL exposures every three months.

[Note to paragraph (d)(3): The employer may decrease the frequency of exposure monitoring to every six months when at least 2 consecutive measurements taken at least 7 days apart show exposures to be at or below the 8-hour TWA PEL. The employer may discontinue the periodic 8-hour TWA monitoring for employees where at least two consecutive measurements taken at least 7 days apart are below the action level. The employer may discontinue the periodic STEL monitoring for employees where at least two consecutive measurements taken at least 7 days apart are at or below the STEL.]

(4) *Additional monitoring.* (i) The employer shall perform exposure monitoring when a change in workplace conditions indicates that employee exposure may have increased. Examples of situations that may require additional monitoring include changes in production, process, control equipment, or work practices, or a leak, rupture, or other breakdown.

(ii) Where exposure monitoring is performed due to a spill, leak, rupture or equipment breakdown, the employer shall clean-up the MC and perform the appropriate repairs before monitoring.

(5) *Employee notification of monitoring results.* (i) The employer shall, within 15 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results in writing, either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) Whenever monitoring results indicate that employee exposure is above the 8-hour TWA PEL or the STEL, the employer shall describe in the

written notification the corrective action being taken to reduce employee exposure to or below the 8-hour TWA PEL or STEL and the schedule for completion of this action.

(6) *Observation of monitoring.* (i) *Employee observation.* The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to MC conducted in accordance with this section.

(ii) *Observation procedures.* When observation of the monitoring of employee exposure to MC requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide, at no cost to the observer(s), and the observer(s) shall be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(e) *Regulated areas.* (1) The employer shall establish a regulated area wherever an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed either the 8-hour TWA PEL or the STEL.

(2) The employer shall limit access to regulated areas to authorized persons.

(3) The employer shall supply a respirator, selected in accordance with paragraph (h)(3) of this section, to each person who enters a regulated area and shall require each affected employee to use that respirator whenever MC exposures are likely to exceed the 8-hour TWA PEL or STEL.

[Note to paragraph (e)(3): An employer who has implemented all feasible engineering, work practice and

administrative controls (as required in paragraph (f) of this section), and who has established a regulated area (as required by paragraph (e)(1) of this section) where MC exposure can be reliably predicted to exceed the 8-hour TWA PEL or the STEL only on certain days (for example, because of work or process schedule) would need to have affected employees use respirators in that regulated area only on those days.]

(4) The employer shall ensure that, within a regulated area, employees do not engage in non-work activities which may increase dermal or oral MC exposure.

(5) The employer shall ensure that while employees are wearing respirators, they do not engage in activities (such as taking medication or chewing gum or tobacco) which interfere with respirator seal or performance.

(6) The employer shall demarcate regulated areas from the rest of the workplace in any manner that adequately establishes and alerts employees to the boundaries of the area and minimizes the number of authorized employees exposed to MC within the regulated area.

(7) An employer at a multi-employer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to all other employers with work operations at that worksite.

(f) *Methods of compliance.* (1) *Engineering and work practice controls.* The employer shall institute and

maintain the effectiveness of engineering controls and work practices to reduce employee exposure to or below the PELs except to the extent that the employer can demonstrate that such controls are not feasible. Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the 8-TWA PEL or STEL, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of paragraph (g) of this section.

(2) *Prohibition of rotation.* The employer shall not implement a schedule of employee rotation as a means of compliance with the PELs.

(3) *Leak and spill detection.* (i) The employer shall implement procedures to detect leaks of MC in the workplace. In work areas where spills may occur, the employer shall make provisions to contain any spills and to safely dispose of any MC-contaminated waste materials.

(ii) The employer shall ensure that all incidental leaks are repaired and that incidental spills are cleaned promptly

by employees who use the appropriate personal protective equipment and are trained in proper methods of cleanup. [Note to paragraph (f)(3)(ii): See Appendix A of this section for examples of procedures that satisfy this requirement. Employers covered by this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (q).]

(g) *Respiratory protection.* (1) *General requirements.* The employer shall provide a respirator which complies with the requirement of this paragraph, at no cost to each affected employee, and ensure that each affected employee uses such respirator where appropriate. Respirators shall be used in the following circumstances:

(i) Whenever an employee's exposure to MC exceeds or can reasonably be expected to exceed the 8-hour TWA PEL or the STEL (such as where an employee is using MC in a regulated area);

(ii) During the time interval necessary to install or implement feasible engineering and work practice controls;

(iii) In a few work operations, such as some maintenance operations and repair activities, for which the employer demonstrates that engineering and work practice controls are infeasible;

(iv) Where feasible engineering and work practice controls are not sufficient to reduce exposures to or below the PELs; or

(v) In emergencies.

(2) *Medical Evaluation.* Before having any employee use a supplied-air respirator in the negative pressure mode, or a gas mask with organic vapor canister for emergency escape, the employer shall have a physician or other licensed health care professional ascertain each affected employee's ability to use such respiratory protection. The physician or other licensed health care professional shall provide his or her findings to the affected employee and the employer in a written opinion.

(3) *Respirator selection.* The appropriate atmosphere-supplying respirators, as specified in Table 2, shall be selected from those approved by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 42 CFR Part 84, "Respiratory Protective Devices." When employers elect to provide gas masks with organic vapor canisters for use in emergency escape, the organic vapor canisters shall bear the approval of NIOSH.

TABLE 2.—MINIMUM REQUIREMENTS FOR RESPIRATORY PROTECTION FOR AIRBORNE METHYLENE CHLORIDE

Methylene chloride airborne concentration (ppm) or condition of use	Minimum respirator required ¹
Up to 625 ppm (25 X PEL)	(1) Continuous flow supplied-air respirator, hood or helmet.
Up to 1250 ppm (50 X 8-TWA PEL)	(1) Full facepiece supplied-air respirator operated in negative pressure (demand) mode. (2) Full facepiece self-contained breathing apparatus (SCBA) operated in negative pressure (demand) mode.
Up to 5000 ppm (200 X 8-TWA PEL)	(1) Continuous flow supplied-air respirator, full facepiece. (2) Pressure demand supplied-air respirator, full facepiece. (3) Positive pressure full facepiece SCBA.
Unknown concentration, or above 5000 ppm (Greater than 200 X 8-TWA PEL).	(1) Positive pressure full facepiece SCBA. (2) Full facepiece pressure demand supplied-air respirator with an auxiliary self-contained air supply.
Fire fighting	Positive pressure full facepiece SCBA.
Emergency escape	(1) Any continuous flow or pressure demand SCBA. (2) Gas mask with organic vapor canister.

¹ Respirators assigned for higher airborne concentrations may be used at lower concentrations.

(4) *Respirator program.* Where respiratory protection is required by this section, the employer shall institute a respirator program in accordance with 29 CFR 1910.134.

(5) *Permission to leave area.* The employer shall permit employees who wear respirators to leave the regulated area to readjust the facepieces to their faces to achieve a proper fit, and to wash their faces and respirator facepieces as necessary in order to prevent skin irritation associated with respirator use.

(6) *Filter respirators.* Employers who provide gas masks with organic vapor canisters for the purpose of emergency escape shall replace those canisters after any emergency use before those gas masks are returned to service.

(7) *Respirator fit testing.* (i) The employer shall ensure that each respirator issued to the employee is properly fitted and exhibits the least possible facepiece leakage from among the facepieces tested.

(ii) The employer shall perform qualitative or quantitative fit tests at the time of initial fitting and at least

annually thereafter for each employee wearing a negative pressure respirator, including those employees for whom emergency escape respirators are provided.

[Note to paragraph (g)(7)(ii): The only supplied-air respirators to which this provision would apply are SCBA in negative pressure mode and full facepiece supplied-air respirators operated in negative pressure mode. The small business compliance guides will contain examples of protocols for qualitative and quantitative fit testing.]

(h) *Protective Work Clothing and Equipment.* (1) Where needed to prevent

MC-induced skin or eye irritation, the employer shall provide clean protective clothing and equipment which is resistant to MC, at no cost to the employee, and shall ensure that each affected employee uses it. Eye and face protection shall meet the requirements of 29 CFR 1910.133 or 29 CFR 1915.153, as applicable.

(2) The employer shall clean, launder, repair and replace all protective clothing and equipment required by this paragraph as needed to maintain their effectiveness.

(3) The employer shall be responsible for the safe disposal of such clothing and equipment. [Note to paragraph (h)(4): See Appendix A for examples of disposal procedures that will satisfy this requirement.]

(i) *Hygiene facilities.* (1) If it is reasonably foreseeable that employees' skin may contact solutions containing 0.1 percent or greater MC (for example, through splashes, spills or improper work practices), the employer shall provide conveniently located washing facilities capable of removing the MC, and shall ensure that affected employees use these facilities as needed.

(2) If it is reasonably foreseeable that an employee's eyes may contact solutions containing 0.1 percent or greater MC (for example through splashes, spills or improper work practices), the employer shall provide appropriate eyewash facilities within the immediate work area for emergency use, and shall ensure that affected employees use those facilities when necessary.

(j) *Medical surveillance.* (1) *Affected employees.* The employer shall make medical surveillance available for employees who are or may be exposed to MC as follows:

(i) At or above the action level on 30 or more days per year, or above the 8-hour TWA PEL or the STEL on 10 or more days per year;

(ii) Above the 8-TWA PEL or STEL for any time period where an employee has been identified by a physician or other licensed health care professional as being at risk from cardiac disease or from some other serious MC-related health condition and such employee requests inclusion in the medical surveillance program;

(iii) During an emergency.

(2) *Costs.* The employer shall provide all required medical surveillance at no cost to affected employees, without loss of pay and at a reasonable time and place.

(3) *Medical personnel.* The employer shall ensure that all medical surveillance procedures are performed by a physician or other licensed health

care professional, as defined in paragraph (b) of this section.

(4) *Frequency of medical surveillance.* The employer shall make medical surveillance available to each affected employee as follows:

(i) *Initial surveillance.* The employer shall provide initial medical surveillance under the schedule provided by paragraph (n)(2)(iii) of this section, or before the time of initial assignment of the employee, whichever is later. The employer need not provide the initial surveillance if medical records show that an affected employee has been provided with medical surveillance that complies with this section within 12 months before April 10, 1997.

(ii) *Periodic medical surveillance.* The employer shall update the medical and work history for each affected employee annually. The employer shall provide periodic physical examinations, including appropriate laboratory surveillance, as follows:

(A) For employees 45 years of age or older, within 12 months of the initial surveillance or any subsequent medical surveillance; and

(B) For employees younger than 45 years of age, within 36 months of the initial surveillance or any subsequent medical surveillance.

(iii) *Termination of employment or reassignment.* When an employee leaves the employer's workplace, or is reassigned to an area where exposure to MC is consistently at or below the action level and STEL, medical surveillance shall be made available if six months or more have elapsed since the last medical surveillance.

(iv) *Additional surveillance.* The employer shall provide additional medical surveillance at frequencies other than those listed above when recommended in the written medical opinion. (For example, the physician or other licensed health care professional may determine an examination is warranted in less than 36 months for employees younger than 45 years of age based upon evaluation of the results of the annual medical and work history.)

(5) *Content of medical surveillance.* (i) *Medical and work history.* The comprehensive medical and work history shall emphasize neurological symptoms, skin conditions, history of hematologic or liver disease, signs or symptoms suggestive of heart disease (angina, coronary artery disease), risk factors for cardiac disease, MC exposures, and work practices and personal protective equipment used during such exposures. [Note to paragraph (j)(5)(i): See Appendix B of this section for an example of a medical

and work history format that would satisfy this requirement.]

(ii) *Physical examination.* Where physical examinations are provided as required above, the physician or other licensed health care professional shall accord particular attention to the lungs, cardiovascular system (including blood pressure and pulse), liver, nervous system, and skin. The physician or other licensed health care professional shall determine the extent and nature of the physical examination based on the health status of the employee and analysis of the medical and work history.

(iii) *Laboratory surveillance.* The physician or other licensed health care professional shall determine the extent of any required laboratory surveillance based on the employee's observed health status and the medical and work history. [Note to paragraph (j)(5)(iii): See Appendix B of this section for information regarding medical tests. Laboratory surveillance may include before- and after-shift carboxyhemoglobin determinations, resting ECG, hematocrit, liver function tests and cholesterol levels.]

(iv) *Other information or reports.* The medical surveillance shall also include any other information or reports the physician or other licensed health care professional determines are necessary to assess the employee's health in relation to MC exposure.

(6) *Content of emergency medical surveillance.* The employer shall ensure that medical surveillance made available when an employee has been exposed to MC in emergency situations includes, at a minimum:

(i) Appropriate emergency treatment and decontamination of the exposed employee;

(ii) Comprehensive physical examination with special emphasis on the nervous system, cardiovascular system, lungs, liver and skin, including blood pressure and pulse;

(iii) Updated medical and work history, as appropriate for the medical condition of the employee; and

(iv) Laboratory surveillance, as indicated by the employee's health status. [Note to paragraph (j)(6)(iv): See Appendix B for examples of tests which may be appropriate.]

(7) *Additional examinations and referrals.* Where the physician or other licensed health care professional determines it is necessary, the scope of the medical examination shall be expanded and the appropriate additional medical surveillance, such as referrals for consultation or examination, shall be provided.

(8) *Information provided to the physician or other licensed health care professional.* The employer shall provide the following information to a physician or other licensed health care professional who is involved in the diagnosis of MC-induced health effects:

(i) A copy of this section including its applicable appendices;

(ii) A description of the affected employee's past, current and anticipated future duties as they relate to the employee's MC exposure;

(iii) The employee's former or current exposure levels or, for employees not yet occupationally exposed to MC, the employee's anticipated exposure levels and the frequency and exposure levels anticipated to be associated with emergencies;

(iv) A description of any personal protective equipment, such as respirators, used or to be used; and

(v) Information from previous employment-related medical surveillance of the affected employee which is not otherwise available to the physician or other licensed health care professional.

(9) *Written medical opinions.* (i) For each physical examination required by this section, the employer shall ensure that the physician or other licensed health care professional provides to the employer and to the affected employee a written opinion regarding the results of that examination within 15 days of completion of the evaluation of medical and laboratory findings, but not more than 30 days after the examination. The written medical opinion shall be limited to the following information:

(A) The physician's or other licensed health care professional's opinion concerning whether the employee has any detected medical condition(s) which would place the employee's health at increased risk of material impairment from exposure to MC;

(B) Any recommended limitations upon the employee's exposure to MC or upon the employee's use of protective clothing or equipment and respirators;

(C) A statement that the employee has been informed by the physician or other licensed health care professional that MC is a potential occupational carcinogen, of risk factors for heart disease, and the potential for exacerbation of underlying heart disease by exposure to MC through its metabolism to carbon monoxide; and

(D) A statement that the employee has been informed by the physician or other licensed health care professional of the results of the medical examination and any medical conditions resulting from MC exposure which require further explanation or treatment.

(ii) The employer shall instruct the physician or other licensed health care professional not to reveal to the employer, orally or in the written opinion, any specific records, findings, and diagnoses that have no bearing on occupational exposure to MC. [Note to paragraph (j)(9)(ii): The written medical opinion may also include information and opinions generated to comply with other OSHA health standards.]

(k) *Hazard communication.* The employer shall communicate the following hazards associated with MC on labels and in material safety data sheets in accordance with the requirements of the Hazard Communication Standard, 29 CFR 1910.1200, 29 CFR 1915.1200, or 29 CFR 1926.59, as appropriate: cancer, cardiac effects (including elevation of carboxyhemoglobin), central nervous system effects, liver effects, and skin and eye irritation.

(l) *Employee information and training.* (1) The employer shall provide information and training for each affected employee prior to or at the time of initial assignment to a job involving potential exposure to MC.

(2) The employer shall ensure that information and training is presented in a manner that is understandable to the employees.

(3) In addition to the information required under the Hazard Communication Standard at 29 CFR 1910.1200, 29 CFR 1915.1200, or 29 CFR 1926.59, as appropriate:

(i) The employer shall inform each affected employee of the requirements of this section and information available in its appendices, as well as how to access or obtain a copy of it in the workplace;

(ii) Wherever an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed the action level, the employer shall inform each affected employee of the quantity, location, manner of use, release, and storage of MC and the specific operations in the workplace that could result in exposure to MC, particularly noting where exposures may be above the 8-hour TWA PEL or STEL;

(4) The employer shall train each affected employee as required under the Hazard Communication standard at 29 CFR 1910.1200, 29 CFR 1915.1200, or 29 CFR 1926.59, as appropriate.

(5) The employer shall re-train each affected employee as necessary to ensure that each employee exposed above the action level or the STEL maintains the requisite understanding of the principles of safe use and handling of MC in the workplace.

(6) Whenever there are workplace changes, such as modifications of tasks or procedures or the institution of new tasks or procedures, which increase employee exposure, and where those exposures exceed or can reasonably be expected to exceed the action level, the employer shall update the training as necessary to ensure that each affected employee has the requisite proficiency.

(7) An employer whose employees are exposed to MC at a multi-employer worksite shall notify the other employers with work operations at that site in accordance with the requirements of the Hazard Communication Standard, 29 CFR 1910.1200, 29 CFR 1915.1200, or 29 CFR 1926.59, as appropriate.

(8) The employer shall provide to the Assistant Secretary or the Director, upon request, all available materials relating to employee information and training.

(m) *Recordkeeping.* (1) *Objective data.* (i) Where an employer seeks to demonstrate that initial monitoring is unnecessary through reasonable reliance on objective data showing that any materials in the workplace containing MC will not release MC at levels which exceed the action level or the STEL under foreseeable conditions of exposure, the employer shall establish and maintain an accurate record of the objective data relied upon in support of the exemption.

(ii) This record shall include at least the following information:

(A) The MC-containing material in question;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of MC;

(D) A description of the operation exempted under paragraph (d)(2)(i) of this section and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure measurements.* (i) The employer shall establish and keep an accurate record of all measurements taken to monitor employee exposure to MC as prescribed in paragraph (d) of this section.

(ii) Where the employer has 20 or more employees, this record shall include at least the following information:

(A) The date of measurement for each sample taken;

(B) The operation involving exposure to MC which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of personal protective equipment, such as respiratory protective devices, worn, if any; and

(F) Name, social security number, job classification and exposure of all of the employees represented by monitoring, indicating which employees were actually monitored.

(iii) Where the employer has fewer than 20 employees, the record shall include at least the following information:

(A) The date of measurement for each sample taken;

(B) Number, duration, and results of samples taken; and

(C) Name, social security number, job classification and exposure of all of the employees represented by monitoring, indicating which employees were actually monitored.

(iv) The employer shall maintain this record for at least thirty (30) years, in accordance with 29 CFR 1910.1020.

(3) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance under paragraph (j) of this section.

(ii) The record shall include at least the following information:

(A) The name, social security number and description of the duties of the employee;

(B) Written medical opinions; and

(C) Any employee medical conditions related to exposure to MC.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with 29 CFR 1910.1020.

(4) *Availability.* (i) The employer, upon written request, shall make all records required to be maintained by this section available to the Assistant Secretary and the Director for examination and copying in accordance with 29 CFR 1910.1020. [Note to paragraph (m)(4)(i): All records required to be maintained by this section may be kept in the most administratively convenient form (for example, electronic or computer records would satisfy this requirement).]

(ii) The employer, upon request, shall make any employee exposure and objective data records required by this section available for examination and copying by affected employees, former employees, and designated representatives in accordance with 29 CFR 1910.1020.

(iii) The employer, upon request, shall make employee medical records

required to be kept by this section available for examination and copying by the subject employee and by anyone having the specific written consent of the subject employee in accordance with 29 CFR 1910.1020.

(5) *Transfer of records.* The employer shall comply with the requirements concerning transfer of records set forth in 29 CFR 1910.1020(h).

(n) *Dates.* (1) *Effective date.* This section shall become effective April 10, 1997.

(2) *Start-up dates.*

(i) Initial monitoring required by paragraph (d)(2) of this section shall be completed according to the following schedule:

(A) For employers with fewer than 20 employees, within 300 days after the effective date of this section.

(B) For polyurethane foam manufacturers with 20 to 99 employees, within 210 days after the effective date of this section.

(C) For all other employers, within 120 days after the effective date of this section.

(ii) Engineering controls required under paragraph (f)(1) of this section shall be implemented according to the following schedule:

(A) For employers with fewer than 20 employees, within three (3) years after the effective date of this section.

(B) For polyurethane foam manufacturers with 20 to 99 employees, within two (2) years after the effective date of this section.

(C) For all other employers, within one (1) year after the effective date of this section.

(iii) All other requirements of this section shall be complied with according to the following schedule:

(A) For employers with fewer than 20 employees, within one (1) year after the effective date of this section.

(B) For polyurethane foam manufacturers with 20 to 99 employees, within 270 days after the effective date of this section.

(C) For all other employers, within 180 days after the effective date of this section.

(3) *Transitional dates.* The exposure limits for MC specified in 29 CFR 1910.1000 (1996), Table Z-2, shall remain in effect until the start-up dates for the exposure limits specified in paragraph (n) of this section, or if the exposure limits in this section are stayed or vacated.

(o) *Appendices.* The information contained in the appendices does not, by itself, create any additional obligations not otherwise imposed or detract from any existing obligation.

Appendix A to Section 1910.1052: Substance Safety Data Sheet and Technical Guidelines for Methylene Chloride

I. Substance Identification

A. Substance: Methylene chloride (CH₂Cl₂).

B. Synonyms: MC, Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride; CAS: 75-09-2; NCI-C50102.

C. Physical data:

1. Molecular weight: 84.9.

2. Boiling point (760 mm Hg): 39.8°C (104°F).

3. Specific gravity (water=1): 1.3.

4. Vapor density (air=1 at boiling point):

2.9.

5. Vapor pressure at 20° C (68° F): 350 mm Hg.

6. Solubility in water, g/100 g water at 20° C (68° F)=1.32.

7. Appearance and odor: colorless liquid with a chloroform-like odor.

D. Uses:

MC is used as a solvent, especially where high volatility is required. It is a good solvent for oils, fats, waxes, resins, bitumen, rubber and cellulose acetate and is a useful paint stripper and degreaser. It is used in paint removers, in propellant mixtures for aerosol containers, as a solvent for plastics, as a degreasing agent, as an extracting agent in the pharmaceutical industry and as a blowing agent in polyurethane foams. Its solvent property is sometimes increased by mixing with methanol, petroleum naphtha or tetrachloroethylene.

E. Appearance and odor:

MC is a clear colorless liquid with a chloroform-like odor. It is slightly soluble in water and completely miscible with most organic solvents.

F. Permissible exposure:

Exposure may not exceed 25 parts MC per million parts of air (25 ppm) as an eight-hour time-weighted average (8-hour TWA PEL) or 125 parts of MC per million parts of air (125 ppm) averaged over a 15-minute period (STEL).

II. Health Hazard Data

A. MC can affect the body if it is inhaled or if the liquid comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

B. Effects of overexposure:

1. Short-term Exposure:

MC is an anesthetic. Inhaling the vapor may cause mental confusion, light-headedness, nausea, vomiting, and headache. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. High vapor concentrations may also cause irritation of the eyes and respiratory tract. Exposure to MC may make the symptoms of angina (chest pains) worse. Skin exposure to liquid MC may cause irritation. If liquid MC remains on the skin, it may cause skin burns. Splashes of the liquid into the eyes may cause irritation.

2. Long-term (chronic) exposure:

The best evidence that MC causes cancer is from laboratory studies in which rats, mice and hamsters inhaled MC 6 hours per day,

5 days per week for 2 years. MC exposure produced lung and liver tumors in mice and mammary tumors in rats. No carcinogenic effects of MC were found in hamsters.

There are also some human epidemiological studies which show an association between occupational exposure to MC and increases in biliary (bile duct) cancer and a type of brain cancer. Other epidemiological studies have not observed a relationship between MC exposure and cancer. OSHA interprets these results to mean that there is suggestive (but not absolute) evidence that MC is a human carcinogen.

C. Reporting signs and symptoms:

You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to MC.

D. Warning Properties:

1. Odor Threshold:

Different authors have reported varying odor thresholds for MC. Kirk-Othmer and Sax both reported 25 to 50 ppm; Summer and May both reported 150 ppm; Spector reports 320 ppm. Patty, however, states that since one can become adapted to the odor, MC should not be considered to have adequate warning properties.

2. Eye Irritation Level:

Kirk-Othmer reports that "MC vapor is seriously damaging to the eyes." Sax agrees with Kirk-Othmer's statement. The ACGIH Documentation of TLVs states that irritation of the eyes has been observed in workers exposed to concentrations up to 5000 ppm.

3. Evaluation of Warning Properties:

Since a wide range of MC odor thresholds are reported (25–320 ppm), and human adaptation to the odor occurs, MC is considered to be a material with poor warning properties.

III. Emergency First Aid Procedures

In the event of emergency, institute first aid procedures and send for first aid or medical assistance.

A. Eye and Skin Exposures:

If there is a potential for liquid MC to come in contact with eye or skin, face shields and skin protective equipment must be provided and used. If liquid MC comes in contact with the eye, get medical attention. Contact lenses should not be worn when working with this chemical.

B. Breathing:

If a person breathes in large amounts of MC, move the exposed person to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

C. Rescue:

Move the affected person from the hazardous exposure immediately. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises. Do not become a casualty yourself.

IV. Respirators, Protective Clothing, and Eye Protection

A. Respirators:

Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not feasible, when such controls are in the process of being installed, or when these controls fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations.

If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (MSHA) or the National Institute for Occupational Safety and Health (NIOSH). Supplied-air respirators are *required* because air-purifying respirators do not provide adequate respiratory protection against MC.

In addition to respirator selection, a complete written respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation. If you can smell MC while wearing a respirator, proceed immediately to fresh air. If you experience difficulty in breathing while wearing a respirator, tell your employer.

B. Protective Clothing:

Employees must be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid MC or contact with vessels containing liquid MC. Any clothing which becomes wet with liquid MC should be removed immediately and not reworn until the employer has ensured that the protective clothing is fit for reuse. Contaminated protective clothing should be placed in a regulated area designated by the employer for removal of MC before the clothing is laundered or disposed of. Clothing and equipment should remain in the regulated area until all of the MC contamination has evaporated; clothing and equipment should then be laundered or disposed of as appropriate.

C. Eye Protection:

Employees should be provided with and required to use splash-proof safety goggles where liquid MC may contact the eyes.

V. Housekeeping and Hygiene Facilities

For purposes of complying with 29 CFR 1910.141, the following items should be emphasized:

A. The workplace should be kept clean, orderly, and in a sanitary condition. The employer should institute a leak and spill detection program for operations involving liquid MC in order to detect sources of fugitive MC emissions.

B. Emergency drench showers and eyewash facilities are recommended. These should be maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of MC from the skin.

C. Because of the hazardous nature of MC, contaminated protective clothing should be

placed in a regulated area designated by the employer for removal of MC before the clothing is laundered or disposed of.

VI. Precautions for Safe Use, Handling, and Storage

A. Fire and Explosion Hazards:

MC has no flash point in a conventional closed tester, but it forms flammable vapor-air mixtures at approximately 100°C (212°F), or higher. It has a lower explosion limit of 12%, and an upper explosion limit of 19% in air. It has an autoignition temperature of 556.1°C (1033°F), and a boiling point of 39.8°C (104°F). It is heavier than water with a specific gravity of 1.3. It is slightly soluble in water.

B. Reactivity Hazards:

Conditions contributing to the instability of MC are heat and moisture. Contact with strong oxidizers, caustics, and chemically active metals such as aluminum or magnesium powder, sodium and potassium may cause fires and explosions.

Special precautions: Liquid MC will attack some forms of plastics, rubber, and coatings.

C. Toxicity:

Liquid MC is painful and irritating if splashed in the eyes or if confined on the skin by gloves, clothing, or shoes. Vapors in high concentrations may cause narcosis and death. Prolonged exposure to vapors may cause cancer or exacerbate cardiac disease.

D. Storage:

Protect against physical damage. Because of its corrosive properties, and its high vapor pressure, MC should be stored in plain, galvanized or lead lined, mild steel containers in a cool, dry, well ventilated area away from direct sunlight, heat source and acute fire hazards.

E. Piping Material:

All piping and valves at the loading or unloading station should be of material that is resistant to MC and should be carefully inspected prior to connection to the transport vehicle and periodically during the operation.

F. Usual Shipping Containers:

Glass bottles, 5- and 55-gallon steel drums, tank cars, and tank trucks.

Note: This section addresses MC exposure in marine terminal and longshore employment only where leaking or broken packages allow MC exposure that is not addressed through compliance with 29 CFR parts 1917 and 1918, respectively.

G. Electrical Equipment:

Electrical installations in Class I hazardous locations as defined in Article 500 of the National Electrical Code, should be installed according to Article 501 of the code; and electrical equipment should be suitable for use in atmospheres containing MC vapors. See *Flammable and Combustible Liquids Code* (NFPA No. 325M), *Chemical Safety Data Sheet SD-86* (Manufacturing Chemists' Association, Inc.).

H. Fire Fighting:

When involved in fire, MC emits highly toxic and irritating fumes such as phosgene, hydrogen chloride and carbon monoxide. Wear breathing apparatus and use water spray to keep fire-exposed containers cool. Water spray may be used to flush spills away from exposures. Extinguishing media are dry

chemical, carbon dioxide, foam. For purposes of compliance with 29 CFR 1910.307, locations classified as hazardous due to the presence of MC shall be Class I.

I. Spills and Leaks:

Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed. If MC has spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.

J. Methods of Waste Disposal:

Small spills should be absorbed onto sand and taken to a safe area for atmospheric evaporation. Incineration is the preferred method for disposal of large quantities by mixing with a combustible solvent and spraying into an incinerator equipped with acid scrubbers to remove hydrogen chloride gases formed. Complete combustion will convert carbon monoxide to carbon dioxide. Care should be taken for the presence of phosgene.

K. You should not keep food, beverage, or smoking materials, or eat or smoke in regulated areas where MC concentrations are above the permissible exposure limits.

L. Portable heating units should not be used in confined areas where MC is used.

M. Ask your supervisor where MC is used in your work area and for any additional plant safety and health rules.

VII. Medical Requirements

Your employer is required to offer you the opportunity to participate in a medical surveillance program if you are exposed to MC at concentrations at or above the action level (12.5 ppm 8-hour TWA) for more than 30 days a year or at concentrations exceeding the PELs (25 ppm 8-hour TWA or 125 ppm 15-minute STEL) for more than 10 days a year. If you are exposed to MC at concentrations over either of the PELs, your employer will also be required to have a physician or other licensed health care professional ensure that you are able to wear the respirator that you are assigned. Your employer must provide all medical examinations relating to your MC exposure at a reasonable time and place and at no cost to you.

VIII. Monitoring and Measurement Procedures

A. Exposure above the Permissible Exposure Limit:

1. Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken with consecutive samples covering the full shift. Air samples must be taken in the employee's breathing zone.

2. Monitoring techniques: The sampling and analysis under this section may be performed by collection of the MC vapor on two charcoal adsorption tubes in series or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by instruments such as real-time continuous

monitoring systems, portable direct reading instruments, or passive dosimeters as long as measurements taken using these methods accurately evaluate the concentration of MC in employees' breathing zones.

OSHA method 80 is an example of a validated method of sampling and analysis of MC. Copies of this method are available from OSHA or can be downloaded from the Internet at <http://www.osha.gov>. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his or her unique field conditions. The standard requires that the method of monitoring must be accurate, to a 95 percent confidence level, to plus or minus 25 percent for concentrations of MC at or above 25 ppm, and to plus or minus 35 percent for concentrations at or below 25 ppm. In addition to OSHA method 80, there are numerous other methods available for monitoring for MC in the workplace.

B. Since many of the duties relating to employee exposure are dependent on the results of measurement procedures, employers must assure that the evaluation of employee exposure is performed by a technically qualified person.

IX. Observation of Monitoring

Your employer is required to perform measurements that are representative of your exposure to MC and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear, protective clothing and equipment.

X. Access To Information

A. Your employer is required to inform you of the information contained in this Appendix. In addition, your employer must instruct you in the proper work practices for using MC, emergency procedures, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to MC. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being over exposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.

C. Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least thirty (30) years.

D. Your employer is required to release your exposure and medical records to you or your representative upon your request.

E. Your employee is required to provide labels and material safety data sheets (MSDS) for all materials, mixtures or solutions composed of greater than 0.1 percent MC. An example of a label that would satisfy these requirements would be:

Danger Contains Methylene Chloride
Potential Cancer Hazard

May worsen heart disease because methylene chloride is converted to carbon monoxide in the body.

May cause dizziness, headache, irritation of the throat and lungs, loss of consciousness and death at high concentrations (for example, if used in a poorly ventilated room).

Avoid Skin Contact. Contact with liquid causes skin and eye irritation.

XI. Common Operations and Controls

The following list includes some common operations in which exposure to MC may occur and control methods which may be effective in each case:

Operations	Controls
Use as solvent in paint and varnish removers; manufacture of aerosols; cold cleaning and ultrasonic cleaning; and as a solvent in furniture stripping.	General dilution ventilation; local exhaust ventilation; personal protective equipment; substitution.
Use as solvent in vapor degreasing.	Process enclosure; local exhaust ventilation; chilling coils; substitution.
Use as a secondary refrigerant in air conditioning and scientific testing.	General dilution ventilation; local exhaust ventilation; personal protective equipment.

Appendix B to Section 1910.1052: Medical Surveillance for Methylene Chloride

I. Primary Route of Entry

Inhalation.

II. Toxicology

Methylene Chloride (MC) is primarily an inhalation hazard. The principal acute hazardous effects are the depressant action on the central nervous system, possible cardiac toxicity and possible liver toxicity. The range of CNS effects are from decreased eye/hand coordination and decreased performance in vigilance tasks to narcosis and even death of individuals exposed at very high doses. Cardiac toxicity is due to the metabolism of MC to carbon monoxide, and the effects of carbon monoxide on heart tissue. Carbon monoxide displaces oxygen in the blood, decreases the oxygen available to heart tissue, increasing the risk of damage to the heart, which may result in heart attacks in susceptible individuals. Susceptible individuals include persons with heart disease and those with risk factors for heart disease.

Elevated liver enzymes and irritation to the respiratory passages and eyes have also been reported for both humans and experimental animals exposed to MC vapors.

MC is metabolized to carbon monoxide and carbon dioxide via two separate pathways. Through the first pathway, MC is metabolized to carbon monoxide as an end-product via the P-450 mixed function oxidase pathway located in the microsomal

fraction of the cell. This biotransformation of MC to carbon monoxide occurs through the process of microsomal oxidative dechlorination which takes place primarily in the liver. The amount of conversion to carbon monoxide is significant as measured by the concentration of carboxyhemoglobin, up to 12% measured in the blood following occupational exposure of up to 610 ppm. Through the second pathway, MC is metabolized to carbon dioxide as an end product (with formaldehyde and formic acid as metabolic intermediates) via the glutathione dependent enzyme found in the cytosolic fraction of the liver cell. Metabolites along this pathway are believed to be associated with the carcinogenic activity of MC.

MC has been tested for carcinogenicity in several laboratory rodents. These rodent studies indicate that there is clear evidence that MC is carcinogenic to male and female mice and female rats. Based on epidemiologic studies, OSHA has concluded that there is suggestive evidence of increased cancer risk in MC-related worker populations. The epidemiological evidence is consistent with the finding of excess cancer in the experimental animal studies. NIOSH regards MC as a potential occupational carcinogen and the International Agency for Research Cancer (IARC) classifies MC as an animal carcinogen. OSHA considers MC as a suspected human carcinogen.

III. Medical Signs and Symptoms of Acute Exposure

Skin exposure to liquid MC may cause irritation or skin burns. Liquid MC can also be irritating to the eyes. MC is also absorbed through the skin and may contribute to the MC exposure by inhalation.

At high concentrations in air, MC may cause nausea, vomiting, light-headedness, numbness of the extremities, changes in blood enzyme levels, and breathing problems, leading to bronchitis and pulmonary edema, unconsciousness and even death.

At lower concentrations in air, MC may cause irritation to the skin, eye, and respiratory tract and occasionally headache and nausea. Perhaps the greatest problem from exposure to low concentrations of MC is the CNS effects on coordination and alertness that may cause unsafe operations of machinery and equipment, leading to self-injury or accidents.

Low levels and short duration exposures do not seem to produce permanent disability, but chronic exposures to MC have been demonstrated to produce liver toxicity in animals, and therefore, the evidence is suggestive for liver toxicity in humans after chronic exposure.

Chronic exposure to MC may also cause cancer.

IV. Surveillance and Preventive Considerations

As discussed above, MC is classified as a suspect or potential human carcinogen. It is a central nervous system (CNS) depressant and a skin, eye and respiratory tract irritant. At extremely high concentrations, MC has caused liver damage in animals.

MC principally affects the CNS, where it acts as a narcotic. The observation of the symptoms characteristic of CNS depression, along with a physical examination, provides the best detection of early neurological disorders. Since exposure to MC also increases the carboxyhemoglobin level in the blood, ambient carbon monoxide levels would have an additive effect on that carboxyhemoglobin level. Based on such information, a periodic post-shift carboxyhemoglobin test as an index of the presence of carbon monoxide in the blood is recommended, but not required, for medical surveillance.

Based on the animal evidence and three epidemiologic studies previously mentioned, OSHA concludes that MC is a suspect human carcinogen. The medical surveillance program is designed to observe exposed workers on a regular basis. While the medical surveillance program cannot detect MC-induced cancer at a preneoplastic stage, OSHA anticipates that, as in the past, early detection and treatments of cancers leading to enhanced survival rates will continue to evolve.

A. Medical and Occupational History:

The medical and occupational work history plays an important role in the initial evaluation of workers exposed to MC. It is therefore extremely important for the examining physician or other licensed health care professional to evaluate the MC-exposed worker carefully and completely and to focus the examination on MC's potentially associated health hazards. The medical evaluation must include an annual detailed work and medical history with special emphasis on cardiac history and neurological symptoms.

An important goal of the medical history is to elicit information from the worker regarding potential signs or symptoms associated with increased levels of carboxyhemoglobin due to the presence of carbon monoxide in the blood. Physicians or other licensed health care professionals should ensure that the smoking history of all MC exposed employees is known. Exposure to MC may cause a significant increase in carboxyhemoglobin level in all exposed persons. However, smokers as well as workers with anemia or heart disease and those concurrently exposed to carbon monoxide are at especially high risk of toxic effects because of an already reduced oxygen carrying capacity of the blood.

A comprehensive or interim medical and work history should also include occurrence of headache, dizziness, fatigue, chest pain, shortness of breath, pain in the limbs, and irritation of the skin and eyes.

In addition, it is important for the physician or other licensed health care professional to become familiar with the operating conditions in which exposure to MC is likely to occur. The physician or other licensed health care professional also must become familiar with the signs and symptoms that may indicate that a worker is receiving otherwise unrecognized and exceptionally high exposure levels of MC.

An example of a medical and work history that would satisfy the requirement for a comprehensive or interim work history is represented by the following:

The following is a list of recommended questions and issues for the self-administered questionnaire for methylene chloride exposure.

Questionnaire For Methylene Chloride Exposure

I. Demographic Information

1. Name
2. Social Security Number
3. Date
4. Date of Birth
5. Age
6. Present occupation
7. Sex
8. Race

II. Occupational History

1. Have you ever worked with methylene chloride, dichloromethane, methylene dichloride, or CH₂Cl₂ (all are different names for the same chemical)? Please list which on the occupational history form if you have not already.

2. If you have worked in any of the following industries and have not listed them on the occupational history form, please do so.

Furniture stripping
Polyurethane foam manufacturing
Chemical manufacturing or formulation
Pharmaceutical manufacturing
Any industry in which you used solvents to clean and degrease equipment or parts
Construction, especially painting and refinishing
Aerosol manufacturing
Any industry in which you used aerosol adhesives

3. If you have not listed hobbies or household projects on the occupational history form, especially furniture refinishing, spray painting, or paint stripping, please do so.

III. Medical History

A. General

1. Do you consider yourself to be in good health? If no, state reason(s).

2. Do you or have you ever had:

- a. Persistent thirst
- b. Frequent urination (three times or more at night)
- c. Dermatitis or irritated skin
- d. Non-healing wounds

3. What prescription or non-prescription medications do you take, and for what reasons?

4. Are you allergic to any medications, and what type of reaction do you have?

B. Respiratory

1. Do you have or have you ever had any chest illnesses or diseases? Explain.

2. Do you have or have you ever had any of the following:

- a. Asthma
- b. Wheezing
- c. Shortness of breath

3. Have you ever had an abnormal chest X-ray? If so, when, where, and what were the findings?

4. Have you ever had difficulty using a respirator or breathing apparatus? Explain.

5. Do any chest or lung diseases run in your family? Explain.

6. Have you ever smoked cigarettes, cigars, or a pipe? Age started:
 7. Do you now smoke?
 8. If you have stopped smoking completely, how old were you when you stopped?
 9. On the average of the entire time you smoked, how many packs of cigarettes, cigars, or bowls of tobacco did you smoke per day?

C. Cardiovascular

1. Have you ever been diagnosed with any of the following: Which of the following apply to you now or did apply to you at some time in the past, even if the problem is controlled by medication? Please explain any yes answers (i.e., when problem was diagnosed, length of time on medication).

- High cholesterol or triglyceride level
 - Hypertension (high blood pressure)
 - Diabetes
 - Family history of heart attack, stroke, or blocked arteries
2. Have you ever had chest pain? If so, answer the next five questions.
- What was the quality of the pain (i.e., crushing, stabbing, squeezing)?
 - Did the pain go anywhere (i.e., into jaw, left arm)?
 - What brought the pain out?
 - How long did it last?
 - What made the pain go away?

3. Have you ever had heart disease, a heart attack, stroke, aneurysm, or blocked arteries anywhere in your body? Explain (when, treatment).

4. Have you ever had bypass surgery for blocked arteries in your heart or anywhere else? Explain.

5. Have you ever had any other procedures done to open up a blocked artery (balloon angioplasty, carotid endarterectomy, clot-dissolving drug)?

6. Do you have or have you ever had (explain each):

- Heart murmur
- Irregular heartbeat
- Shortness of breath while lying flat
- Congestive heart failure
- Ankle swelling
- Recurrent pain anywhere below the waist while walking

7. Have you ever had an electrocardiogram (EKG)? When?

8. Have you ever had an abnormal EKG? If so, when, where, and what were the findings?

9. Do any heart diseases, high blood pressure, diabetes, high cholesterol, or high triglycerides run in your family? Explain.

D. Hepatobiliary and Pancreas

1. Do you now or have you ever drunk alcoholic beverages? Age started: _____
 Age stopped: _____.

2. Average numbers per week:

- Beers: _____, ounces in usual container:
- Glasses of wine: _____, ounces per glass:
- Drinks: _____, ounces in usual container:

3. Do you have or have you ever had (explain each):

- Hepatitis (infectious, autoimmune, drug-induced, or chemical)

- Jaundice
- Elevated liver enzymes or elevated bilirubin

d. Liver disease or cancer

E. Central Nervous System

1. Do you or have you ever had (explain each):

- Headache
 - Dizziness
 - Fainting
 - Loss of consciousness
 - Garbled speech
 - Lack of balance
 - Mental/psychiatric illness
 - Forgetfulness
- #### F. Hematologic

1. Do you have, or have you ever had (explain each):

- Anemia
- Sickle cell disease or trait
- Glucose-6-phosphate dehydrogenase deficiency
- Bleeding tendency disorder

2. If not already mentioned previously, have you ever had a reaction to sulfa drugs or to drugs used to prevent or treat malaria? What was the drug? Describe the reaction.

B. Physical Examination

The complete physical examination, when coupled with the medical and occupational history, assists the physician or other licensed health care professional in detecting pre-existing conditions that might place the employee at increased risk, and establishes a baseline for future health monitoring. These examinations should include:

1. Clinical impressions of the nervous system, cardiovascular function and pulmonary function, with additional tests conducted where indicated or determined by the examining physician or other licensed health care professional to be necessary.

2. An evaluation of the advisability of the worker using a respirator, because the use of certain respirators places an additional burden on the cardiopulmonary system. It is necessary for the attending physician or other licensed health care professional to evaluate the cardiopulmonary function of these workers, in order to inform the employer in a written medical opinion of the worker's ability or fitness to work in an area requiring the use of certain types of respiratory protective equipment. The presence of facial hair or scars that might interfere with the worker's ability to wear certain types of respirators should also be noted during the examination and in the written medical opinion.

Because of the importance of lung function to workers required to wear certain types of respirators to protect themselves from MC exposure, these workers must receive an assessment of pulmonary function before they begin to wear a negative pressure respirator and at least annually thereafter. The recommended pulmonary function tests include measurement of the employee's forced vital capacity (FVC), forced expiratory volume at one second (FEV₁), as well as calculation of the ratios of FEV₁ to FVC, and the ratios of measured FVC and measured FEV₁ to expected respective values corrected for variation due to age, sex, race, and height.

Pulmonary function evaluation must be conducted by a physician or other licensed health care professional experienced in pulmonary function tests.

The following is a summary of the elements of a physical exam which would fulfill the requirements under the MC standard:

Physical Exam

I. Skin and appendages

- Irritated or broken skin
- Jaundice
- Clubbing cyanosis, edema
- Capillary refill time
- Pallor

II. Head

- Facial deformities
- Scars
- Hair growth

III. Eyes

- Scleral icterus
- Corneal arcus
- Pupillary size and response
- Fundoscopic exam

IV. Chest

- Standard exam

V. Heart

- Standard exam
- Jugular vein distension
- Peripheral pulses

VI. Abdomen

- Liver span

VII. Nervous System

- Complete standard neurologic exam

VIII. Laboratory

- Hemoglobin and hematocrit
- Alanine aminotransferase (ALT, SGPT)
- Post-shift carboxyhemoglobin

IX. Studies

- Pulmonary function testing
- Electrocardiogram

An evaluation of the oxygen carrying capacity of the blood of employees (for example by measured red blood cell volume) is considered useful, especially for workers acutely exposed to MC.

It is also recommended, but not required, that end of shift carboxyhemoglobin levels be determined periodically, and any level above 3% for non-smokers and above 10% for smokers should prompt an investigation of the worker and his workplace. This test is recommended because MC is metabolized to CO, which combines strongly with hemoglobin, resulting in a reduced capacity of the blood to transport oxygen in the body. This is of particular concern for cigarette smokers because they already have a diminished hemoglobin capacity due to the presence of CO in cigarette smoke.

C. Additional Examinations and Referrals

1. Examination by a Specialist

When a worker examination reveals unexplained symptoms or signs (i.e. in the physical examination or in the laboratory tests), follow-up medical examinations are necessary to assure that MC exposure is not

adversely affecting the worker's health. When the examining physician or other licensed health care professional finds it necessary, additional tests should be included to determine the nature of the medical problem and the underlying cause. Where relevant, the worker should be sent to a specialist for further testing and treatment as deemed necessary.

The final rule requires additional investigations to be covered and it also permits physicians or other licensed health care professionals to add appropriate or necessary tests to improve the diagnosis of disease should such tests become available in the future.

2. Emergencies

The examination of workers exposed to MC in an emergency should be directed at the organ systems most likely to be affected. If the worker has received a severe acute exposure, hospitalization may be required to assure proper medical intervention. It is not possible to precisely define "severe," but the physician or other licensed health care professional's judgement should not merely rest on hospitalization. If the worker has suffered significant conjunctival, oral, or nasal irritation, respiratory distress, or discomfort, the physician or other licensed health care professional should instigate appropriate follow-up procedures. These include attention to the eyes, lungs and the neurological system. The frequency of follow-up examinations should be determined by the attending physician or other licensed health care professional. This

testing permits the early identification essential to proper medical management of such workers.

D. Employer Obligations

The employer is required to provide the responsible physician or other licensed health care professional and any specialists involved in a diagnosis with the following information: a copy of the MC standard including relevant appendices, a description of the affected employee's duties as they relate to his or her exposure to MC; an estimate of the employee's exposure including duration (e.g., 15hr/wk, three 8-hour shifts/wk, full time); a description of any personal protective equipment used by the employee, including respirators; and the results of any previous medical determinations for the affected employee related to MC exposure to the extent that this information is within the employer's control.

E. Physicians' or Other Licensed Health Care Professionals' Obligations

The standard requires the employer to ensure that the physician or other licensed health care professional provides a written statement to the employee and the employer. This statement should contain the physician's or licensed health care professional's opinion as to whether the employee has any medical condition placing him or her at increased risk of impaired health from exposure to MC or use of respirators, as appropriate. The physician or other licensed health care professional should also state his or her opinion regarding any restrictions that should be placed on the

employee's exposure to MC or upon the use of protective clothing or equipment such as respirators. If the employee wears a respirator as a result of his or her exposure to MC, the physician or other licensed health care professional's opinion should also contain a statement regarding the suitability of the employee to wear the type of respirator assigned. Furthermore, the employee should be informed by the physician or other licensed health care professional about the cancer risk of MC and about risk factors for heart disease, and the potential for exacerbation of underlying heart disease by exposure to MC through its metabolism to carbon monoxide. Finally, the physician or other licensed health care professional should inform the employer that the employee has been told the results of the medical examination and of any medical conditions which require further explanation or treatment. This written opinion must not contain any information on specific findings or diagnosis unrelated to employee's occupational exposures.

The purpose in requiring the examining physician or other licensed health care professional to supply the employer with a written opinion is to provide the employer with a medical basis to assist the employer in placing employees initially, in assuring that their health is not being impaired by exposure to MC, and to assess the employee's ability to use any required protective equipment.

BILLING CODE 4510-26-P

Appendix C to Section 1910.1052: Questions and Answers--Methylene Chloride Control in Furniture Stripping--

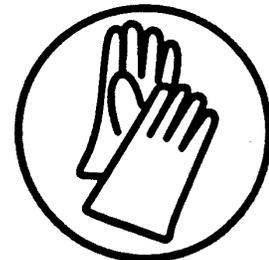
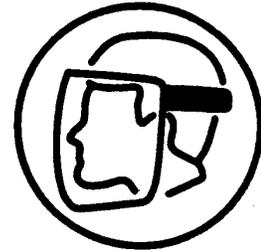


—Questions and Answers—
Methylene Chloride Control in
Furniture Stripping



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
September 1993

NIOSH



Q's & A's

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DHHS (NIOSH) Publication No. 93-133

Introduction

This Pamphlet answers commonly asked questions about the hazards from exposure to methylene chloride. It also describes approaches to controlling methylene chloride exposure during the most common furniture stripping processes. Although these approaches were developed and field tested by NIOSH, each setting requires custom installation because of the different air flow interferences at each site.

What is the Stripping Solution Base?

The most common active ingredient in paint removers is a chemical called methylene chloride. Methylene chloride is present in the paint

remover to penetrate, blister, and finally lift the old finish. Other chemicals in paint removers work to accelerate the stripping process, to retard evaporation, and to act as thickening agents. These other ingredients may include: methanol, toluene, acetone, or paraffin.¹

Is Methylene Chloride Bad for Me?

Exposure to methylene chloride may cause short-term health effects or long-term health effects.

Short-Term (acute) Health Effects

Exposure to high levels of paint removers over short periods of time can cause irritation to the skin, eyes, mucous membranes, and respiratory tract. Other symptoms of high

exposure are dizziness, headache, and lack of coordination. The occurrence of any of these symptoms indicates that you are being exposed to high levels of the methylene chloride. At the onset of any of these symptoms, you should leave the work area, get some fresh air, and determine why the levels were high.

A portion of inhaled methylene chloride is converted by the body to carbon monoxide, which can lower the blood's ability to carry oxygen. When the solvent is used properly, however, the levels of carbon monoxide should not be hazardous. Individuals with cardiovascular or pulmonary health problems should check with their physician before using the paint stripper. Individuals experiencing severe symptoms such as shortness of breath or chest pains should obtain proper medical care immediately.²

Long-term (Chronic) Health Effects

Methylene chloride has been shown to cause cancer in certain laboratory animal tests. The available human studies do not provide the necessary information to determine whether methylene chloride causes cancer in humans. However, as a result of the animal studies, methylene chloride is

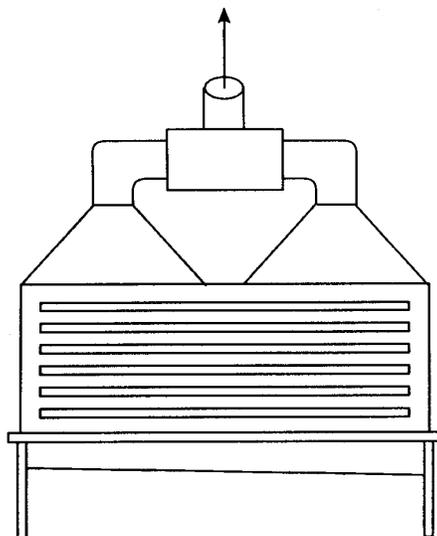
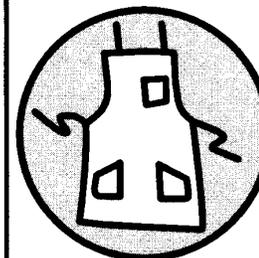
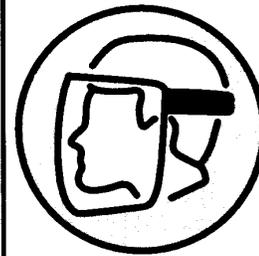


Figure 1 — Slot Hood

Q's & A's



Q's & A's

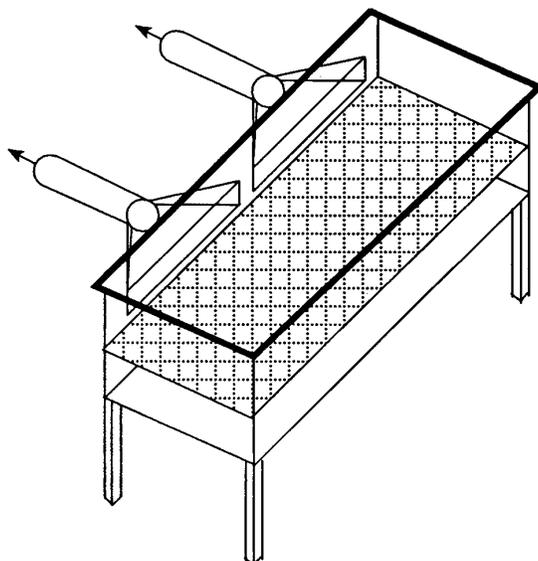


Figure 2 — Downdraft Hood

considered a potential occupational carcinogen. There is also considerable indirect evidence to suggest that workers exposed to methylene chloride may be at increased risk of developing ischemic heart disease. Therefore, it is prudent to minimize exposures to solvent vapors.³

What Do Federal Agencies Say About Methylene Chloride?

In 1991, the Occupational Safety and Health Administration published a Notice of Proposed Rulemaking for methylene chloride. The proposed standard would establish an eight-hour time-weighted average exposure limit of 25 parts per million (ppm), as well

as a short-term exposure limit of 125 ppm determined from a 15 minute sampling period. That is a sharp reduction from the current limit of 500 ppm. The proposed standard would also set a 12.5 ppm action level (a level that would trigger periodic exposure monitoring and medical surveillance provisions).⁴

The National Institute for Occupational Safety and Health recommends that methylene chloride be regarded as a "potential occupational carcinogen." NIOSH further recommends that occupational exposure to methylene chloride be controlled to the lowest feasible limit. This recommendation was based on the observation of cancers and tumors in both rats and mice exposed to methylene chloride in air.⁵

How Can I Be Exposed to Methylene Chloride while Stripping Furniture?

Methylene chloride can be inhaled when vapors are in the air. Inhalation of the methylene chloride vapors is generally the most important source of exposure. Methylene chloride evaporates quicker than most chemicals. The odor threshold of methylene chloride is 300 ppm.⁶ Therefore, once you smell methylene chloride, you are being over-exposed. Pouring, moving, or stirring the chemical will increase the rate of evaporation.

Methylene chloride can be absorbed through the skin either by directly touching the chemical or through your gloves. Methylene chloride can be swallowed if it gets on your hands, clothes, or beard, or if food or drinks become contaminated.

How Can Breathing Exposures be Reduced?

Install a Local Exhaust Ventilation System

Local exhaust ventilation can be used to control exposures. Local exhaust ventilation systems

capture contaminated air from the source before it spreads into the workers' breathing zone.⁷ If engineering controls are not effective, only a self-contained breathing apparatus equipped with a full facepiece and operated in a positive-pressure mode or a supplied-air respirator affords the necessary level of protection. Air-purifying respirators such as organic vapor cartridges can only be used for escape situations.⁸

A local exhaust system consists of the following: a hood, a fan, ductwork, and a replacement air system.^{9,10,11} Two processes are commonly used in furniture stripping: flow-over and dip tanks. For flow-over systems there are two common local exhaust controls for methylene chloride — a slot hood and a downdraft hood. A slot hood of different design is most often used for dip tanks. (See Figures 1, 2, and 3)

The hood is made of sheet metal and connected to the tank. All designs require a centrifugal fan to exhaust the fumes, ductwork connecting the hood and the fan, and a replacement air system to bring conditioned air into the building to replace the air exhausted.

In constructing or designing a slot or downdraft hood, use the following data:

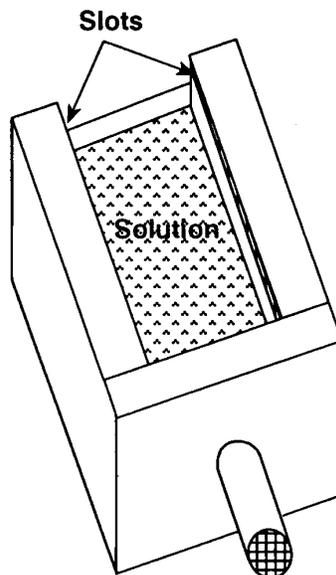


Figure 3 — Slot Hood for Dip Tank

Slot hood (Figure 1)

- At least 2200 cfm per 8' X 4' tank
- 1 - 2 inch slots
- Slot velocity - 1000 fpm
- 3 - 5 slots
- Plenum at least 1 foot deep

Downdraft hood (Figure 2)

- At least 1600 cfm per 8' X 4' tank
- Plenum at least 9" deep

Slot hood for Dip Tank (Figure 3)

- At least 2900 cfm per 8' X 4' tank
- 3/4" slot that runs the length of the front and back of the tank
- Slot velocity — 3200 fpm
- Plenum on the sides of the tank should be 6" deep by 36" long
- 12" duct leads from the center of the front plenum to the fan

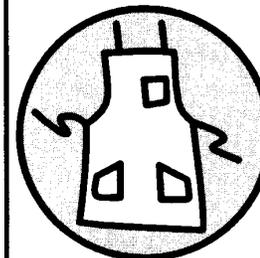
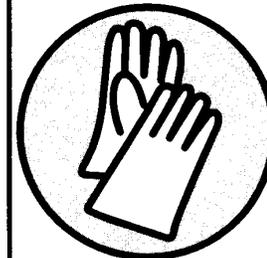
Safe work practices

Workers can lower exposures by decreasing their access to the methyl-

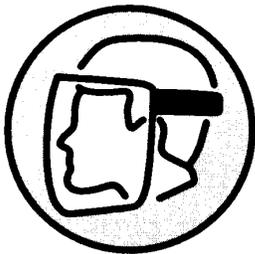
ene chloride.¹²

- 1) Turn on dip tank control system several minutes before entering the stripping area.
- 2) Avoid unnecessary transferring or moving of stripping solution.
- 3) Keep face out of the air stream between the solution-covered furniture and the exhaust system.
- 4) Keep face out of vapor zone above the stripping solution and dip tank.
- 5) Retrieve dropped items with a long handled tool.
- 6) Keep the solution-recycling system off when not in use. Cover reservoir for recycling system.
- 7) Cover dip tank when not in use.
- 8) Provide adequate ventilation for rinse area.

Q's & A's



Q's & A's



How Can Skin Exposures be Reduced?

Skin exposures can be reduced by wearing gloves whenever you are in contact with the stripping solution.¹³

- 1) Two gloves should be worn. The inner glove should be made from polyethylene/ethylene vinyl alcohol (e.g. Silver Shield[®], or 4H[®]). This material, however, does not provide good physical resistance against tears, so an outer glove made from nitrile or neoprene should be worn.
- 2) Shoulder-length gloves will be more protective.
- 3) Change gloves before the break-through time occurs. Rotate several pairs of gloves throughout the day. Let the gloves dry in a warm well ventilated area at least overnight before reuse.
- 4) Keep gloves clean by rinsing often. Keep gloves in good condition. Inspect the gloves before use for pin-holes, cracks, thin spots, and stiffer than normal or sticky surfaces.
- 5) Wear a face shield or goggles to protect face and eyes.

What Other Problems Occur?

Stripping Solution Temperature

Most manufacturers of stripping solution recom-

mend controlling the solution to a temperature of 70°F. This temperature is required for the wax in the solution to form a vapor barrier on top of the solution to keep the solution from evaporating too quickly. If the temperature is too high, the wax will not form the vapor barrier. If it is too cold, the wax will solidify and separate from the solvent causing increased evaporation. Use a belt heater to heat the solution to the correct temperature. Call your solution manufacturer for the correct temperature for your solution.¹⁴

Make-Up Air

Air will enter a building in an amount to equal the amount of air exhausted whether or not provision is made for this replacement. If a local exhaust system is added a make-up or replacement air system must be added to replace the air removed. Without a replacement air system, air will enter the building through cracks causing uncontrollable eddy currents. If the building perimeter is tightly sealed, it will prevent the air from entering and severely decrease the amount exhausted from the

ventilation system. This will cause the building to be under negative pressure and decrease the performance of the exhaust system.¹⁵

Dilution Ventilation

With general or dilution ventilation, uncontaminated air is moved through the workroom by means of fans or open windows, which dilutes the pollutants in the air. Dilution ventilation does not provide effective protection to other workers and does not confine the methylene chloride vapors to one area.¹⁶

Phosgene Poisoning from Use of Kerosene Heaters

Do not use kerosene heaters or other open flame heaters while stripping furniture. Use of kerosene heaters in connection with methylene chloride can create lethal or dangerous concentrations of phosgene. Methylene chloride vapor is mixed with the air used for the combustion of kerosene in kerosene stoves. The vapor thus passes through the flames, coming into close contact with carbon monoxide at high temperatures. Any chlorine formed by decomposition may, under these conditions, react with carbon monoxide and form phosgene.¹⁷

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Q's & A's

Where Should I go for More Information?

The NIOSH 800- number is a toll-free technical information service that provides convenient public access to NIOSH and its information resources. Callers may request information about any aspect of occupational safety and health.

1-800-35-NIOSH
(1-800-356-4674)

PART 1915—[AMENDED]

6. The authority citation for 29 CFR part 1915 continues to read as follows:

Authority: Sec. 41, Longshore and Harbor Workers Compensation Act (33 U.S.C. 941); secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033), as applicable; 29 CFR part 1911.

7. In Table Z of section 1915.1000, *Air Contaminants*, the entire entry for methylene chloride is removed and replaced with the following entry added in the substance column: "Methylene chloride: see § 1910.1052".

8. Subpart Z of part 1915 is amended by adding § 1915.1052, as follows:

§ 1915.1052 Methylene chloride.

Note: The requirements applicable to shipyard employment under this section are

identical to those set forth at 29 CFR 1910.1052.

PART 1926—[AMENDED]**Subpart D—[Amended]**

9. The authority citation for subpart D of part 1926 continues to read as follows:

Authority: Sec. 107, Contract Work Hours and Safety Standards Act (40 U.S.C. 333), secs. 4, 6, and 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Orders No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable.

10. In Appendix A of section 1926.55, *Gases, vapors, fumes, dusts and mists*, the entire entry for methylene chloride is removed and replaced by the following entry added in the substance column: "Methylene chloride: see § 1910.1052".

Subpart Z—[Amended]

11. The authority citation for subpart Z of part 1926 continues to read as follows:

Authority: Secs. 6 and 8, Occupational Safety and Health Act (29 U.S.C. 655, 657); section 41, Secretary of Labor's Orders Nos. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), or 1-90 (55 FR 9033), as applicable; and 29 CFR part 1911.

12. Subpart Z of part 1926 is amended by adding § 1926.1152, as follows:

§ 1926.1152 Methylene chloride.

Note: The requirements applicable to construction employment under this section are identical to those set forth at 29 CFR 1910.1052.

[FR Doc. 97-198 Filed 1-9-97; 8:45 am]

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