Environment

INFORMATION FROM KODAK

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Determining Workplace Exposure to Formaldehyde

INTRODUCTION

This document is intended primarily to help owners or supervisors of photographic processing facilities—*where products containing formaldehyde are used*—comply with the OSHA Formaldehyde Standard. Additional state requirements may apply; be sure you know what they are.

The first thing you need to do is determine if formaldehyde (or products that contain formaldehyde) is used in your workplace. But before you determine workplace exposure, read KODAK Publication No. J-113, *About the OSHA Formaldehyde Standard*, so that you understand the requirements set forth in the OSHA Formaldehyde Standard.

Three resources can help you determine whether formaldehyde is used in your workplace: your chemical inventory, Material Safety Data Sheets (MSDSs), and the table of Kodak products containing formaldehyde on page 6.

If formaldehyde or products that contain formaldehyde are not used in your workplace, STOP. The OSHA Formaldehyde Standard does not apply to you.

If products containing formaldehyde are used in your workplace, you need to either collect or obtain exposure data for levels of formaldehyde in air and in solution. Once you have the data, you can summarize it in table (a Workplace Exposure Summary) or graph form. You can use either the graph or the table to help you determine if you are above OSHA limits.

OSHA requires a hazard communication program and may require initial air monitoring by the employer when concentrates are 0.1% formaldehyde in solution. For 1.0% formaldehyde in solution, personal protective equipment (PPE) is required.

OSHA AIR MONITORING REQUIREMENTS

The following are OSHA limits of formaldehyde in air that trigger employer action:

1 ppm, 8-h TWA	OSHA trigger for "potential hazard"
0.5 ppm, 8-h TWA	OSHA Action Level (AL)
0.75 ppm, 8-h TWA	OSHA Permissible Exposure Limit (PEL)
2.0 ppm, 15-min STEL	OSHA Short-Term Exposure Limit (STEL)

If airborne concentrations of formaldehyde are above the Action Level (AL) upon initial monitoring, you must conduct air monitoring at least every six months.

If airborne concentrations of formaldehyde are above the Short-Term Exposure Limit (STEL) on initial monitoring, air monitoring is required at least once a year.

Air monitoring is also required when changes are made that may result in new or additional exposure, and upon reports of respiratory or skin signs/symptoms associated with formaldehyde exposure.

If products that contain formaldehyde are used in your workplace, it is important that you determine which, if any, employees are potentially exposed to it, and that you understand the OSHA Formaldehyde Standard.

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Air monitoring must be:

- Representative of employee's full shift or short-term exposure, as appropriate.
- Representative of the job and work operation.
- Conducted for each job classification in each work area and each shift (if exposures change on different shifts).

Employers are required to:

- Notify affected employees in writing of results of air monitoring within 15 days of receipt of the results by distributing copies or by posting notices.
- Develop a written plan to reduce levels below the OSHA TWA of 0.75 ppm and the STEL of 2 ppm.
- Provide written notice of plans to employees.

OBTAINING OBJECTIVE DATA

If air monitoring data from your workplace are not available, you can use air monitoring data obtained from sources such as insurance companies, trade associations, suppliers, and vendors. OSHA calls these data "objective data." For more information, call Kodak Environmental Services at (716) 477-3194.

When relying on objective data for exposure determination, be sure that circumstances in your workplace are similar to the circumstances under which the objective data were collected. Many variables can influence exposure, including type of process equipment used, degree of equipment enclosure, presence or absence of equipment or room ventilation, location of equipment within the room, length of operation, type of operation, and variation in operator work practices.

If you use objective data to determine that employees are not exposed to formaldehyde levels that exceed OSHA standards, use these data to complete the Workplace Exposure Summary and keep this information on file at your workplace. No additional monitoring is necessary unless the exposure conditions of the task or procedure change.

AIR MONITORING

If the objective data you have do not adequately reflect the exposure situation in your workplace, you will need to collect air monitoring data for the tasks leading to exposure.

General guidelines for developing an air sampling strategy follow.

An outside consultant or internal safety and health specialist can assist you in collecting air monitoring data. Other resources are available to help you locate a specialist, such as the American Academy of Industrial Hygienists, which can provide you with a list of certified consultants.

OSHA requires employers to allow affected employees or a designated representative to observe monitoring.

AIR MONITORING STRATEGY

Use this section as a guide for performing in-house air monitoring or when working with external consultants. In either case, you should understand your operations before air sampling begins.

BACKGROUND

The air sampling strategy helps you determine where to sample, how many air samples to take, and how to interpret the data. There are no hard and fast rules for how many samples to take. You may decide to take more or fewer air samples depending on the circumstances.

This strategy does not tell you what air sampling methods to use, or how to calculate the air concentrations after air sampling. You should ask your in-house staff or consultant to provide this information, as it depends on the methods used.

SAMPLING STRATEGY BASED ON PRIOR JOB KNOWLEDGE

We strongly recommend that you have a thorough understanding of how jobs and tasks are performed during all work shifts. Without a good understanding of the exposure situation, you will need to take more samples to characterize the exposures. Processes run at elevated temperatures and operations that create aerosols are examples of situations where airborne levels of formaldehyde may be found.

- Observe jobs where employees are performing similar tasks with potential exposure to formaldehyde (e.g., chemical mixer, processing operator, maintenance operator)
  - Make observations during each work shift.
  - Make observations throughout the work shift to determine maximum exposure.
  - Record tasks which result in maximum opportunity for exposure (e.g., adding concentrated formaldehyde when mixing solutions, cleaning or repair of equipment that contains formaldehyde, removing product from drying cabinet).
- Select employees at maximum risk. Examples include employees who:
  - Work closer to, or longer with, the source of formaldehyde.
  - Perform tasks in such a way that greater air concentrations could be generated.
  - Work in the direct path of formaldehyde-contaminated air.
- Monitor employees on each work shift where there are shift-to-shift differences in how the job is performed.

TAKING SAMPLES

Select a subgroup from the total number of employees at maximum risk. Even if you do not observe any differences in how employees who are similarly exposed perform the tasks, select a subgroup which will be representative of the potentially exposed group. You do not need to take air samples to measure a 15-minute STEL if the tasks performed for the job are determined to be at constant levels throughout the work shift, and there are no tasks which result in higher exposures.

For the **8-h TWA sampling**, take operator breathing zone (OBZ) air samples during the full work shift.

- The ideal situation is to sample each of the maximum-risk employees in the subgroup.
- You must take a *minimum of three* samples.

For the **STEL sampling**, take OBZ air samples during tasks or operations that are expected to result in maximum exposure.

Similarly:

- Take *at least three* OBZ samples for each task where there is maximum exposure potential..
- Take as many samples as there are people in the maximum risk subgroup, up to a maximum of ten samples.

Note: If you have not made observations to determine the employees at maximum risk:

- For the TWA assessment, collect three times the number of OBZ samples suggested above.
- For the STEL assessment, collect OBZ samples every 15 minutes throughout the entire shift.

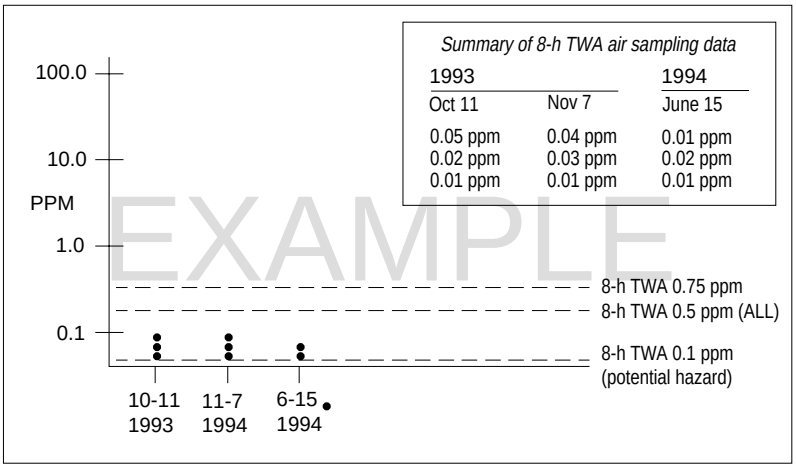
PRESENTING AIR MONITORING RESULTS WITH A GRAPH

- Prepare graphs as shown for the air sampling results of each job that you monitor. Record the TWA and STEL results on separate graphs.

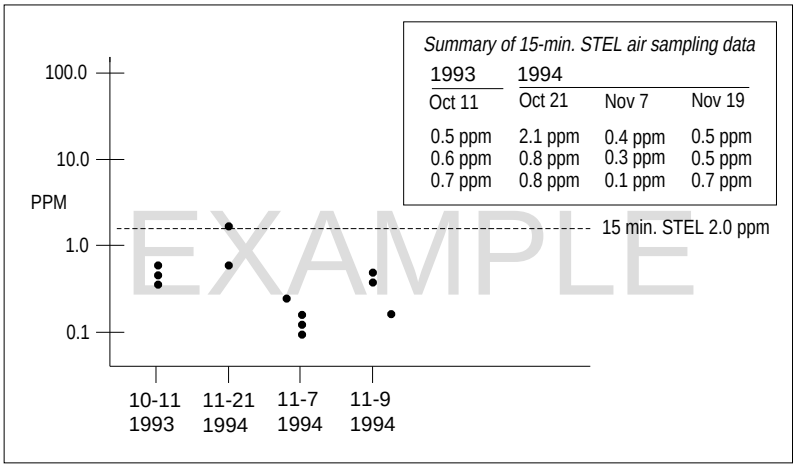
Use semi-log paper. On the horizontal linear axis, enter the dates when the samples were taken. On the vertical (logarithmic) axis, mark the air concentration in parts per million (ppm). Mark 0.01 ppm, 0.1 ppm, 1.0 ppm, 10.0 ppm, and 100 ppm.

Graphing Examples

Job: Mix Room Operator; Tasks/Operation: Making Solutions of XYZ Stabilizer; Day Shift



Job: Mix Room Operator; Tasks/Operation: Manual Addition of Solution Containing 37% Formaldehyde



At each of these limits, there are OSHA sampling requirements.

  - On the 8-h TWA graph, draw horizontal bars to indicate the OSHA TWA limits of 0.5 ppm (action level), and 0.75 ppm (exposure limit).
  - On the STEL graph, draw a horizontal bar at the 2 ppm level to indicate the OSHA 15-minute STEL limit (2.0 ppm). The American Conference of Governmental Industrial Hygienists (ACGIH) also sets limits for employee exposure to certain chemicals. ACGIH limits are not legally binding but are widely accepted on a voluntary basis. If you wish, you can add the ACGIH ceiling limit of 0.3 ppm.

- Plot the ppm results for each sampling day. Plot all 8-h or STEL sampling results on the same graph, so that you can track changes over time and observe the variability of the results.
- Observe where the ppm results (dots) fall. If:
  - All of the air sample results are below the OSHA horizontal limit bar, you don't need to do any further sampling until the job and task change, which may result in higher exposures.
  - If any one of the air samples is *above* the OSHA horizontal limit bar, confirm the results at the earliest opportunity by conducting two consecutive samplings. You can discontinue periodic air monitoring when two consecutive sampling periods, seven days apart, are below the AL and STEL.

PRESENTING AIR MONITORING RESULTS IN A WORKSHEET

Instead of using a graph, you can also provide product, operation, and exposure data in a worksheet. The sample worksheet provided is called a Workplace Exposure Summary form. Use this form to organize your information and help you determine which OSHA requirements apply to your workplace. This form can also document how you made your determination. Use the following instructions, the worksheet on page 7, the example on page 5, and your own knowledge of each job classification and how it is performed to complete the Summary. Make the determinations without considering personal protective equipment that could be used.

PREPARE OR OBTAIN THE FOLLOWING:

- Photocopies of the worksheet on page 7. You will need one worksheet for each job category in which formaldehyde is used.
- MSDSs which include percentages of formaldehyde found in the products you use, and data from any air monitoring studies.

Steps to Prepare a Workplace Exposure Summary

Step (1)

Write in a job category and the corresponding work area at the top of the worksheet.

For tasks and procedures involving potential skin or eye contact with formaldehyde (in a liquid) . . .

Step (2)

List *tasks and procedures* associated with the job classification that involve potential skin or eye contact with formaldehyde, or potential release of formaldehyde into the air.

Step (3)

List the *percentage of formaldehyde* in solution for each task and procedure you listed that involves potential skin or eye contact. Percentages can be found on MSDSs, or in the table of Kodak products containing formaldehyde in this document.

- Use the column "*In Concentrate*" for solutions that are handled as concentrates.
- Use the column "*In Working Solution*" for solutions that are only handled as working solutions.
- Compare this information to the concentration of solution (%) in the Quick Guide. See KODAK Publication J-113, *About the OSHA Formaldehyde Standard*, page 2.

For tasks and procedures involving potential release of formaldehyde to the air . . .

Step (4)

List the *duration* of each task or procedure during a work shift.

Some tasks require an entire work shift. Others require only minutes. If there is more than one work shift, and the duration of the task or procedure differs, list each, and specify the work shift.

Step (5), (6), and (7)

If available, complete these columns using *air monitoring* data for each task and procedure that involves potential exposure to formaldehyde in the air.

If you have a large amount of data that are not grouped by duration (8-h Time-Weighted Average [TWA] or Short-Term Exposure Limit [STEL]), use steps 5, 6 and 7 to note duration, lower and upper levels (range), and the maximum level in that duration category.

Compare these values to the concentration in air (ppm) in the Quick Guide. See KODAK Publication No. J-113, *About the OSHA Formaldehyde Standard*, page 2.

Workplace Exposure Summary Worksheet

STEP 1

Job Category: *Chemical Mix Operator* Work Area: *Mix Room*

STEP 2 Tasks and Procedures	Potential for Skin or Eye Contact?		Potential for Formaldehyde in Air?				Date and Source of Information
	STEP 3 Percent Formaldehyde		STEP 4	STEP 5	STEP 6	STEP 7	
	In Concentrate	In Working Solution	Duration of Task (h) (m)	Number of Samples	Air Concentration Range (ppm)	Maximum Air Concentration (ppm)	
Manual addition of 5 gallons of abc stabilizer							
(Cat No. 000 0000) to mix vessel no. xxx							
(no local exhaust present)	*37*	*< 1*	*10 (m.)*	*3*	*0.5–0.7*	*0.7*	*Oct 11,12,13,1993 (EKC)*
Making photochemical solutions, includes:							
• *Manual addition of 5 gallons of xyz stabilizer*							
(Cat. No. 000 0000) to mix							
vessel no. xxx (exhaust ventilation present)	*37*	*< 1*	*10 (m.)*	*3*	*0.01 – 0.03*	*maximum 0.03*	*Oct 11,12,13,1993 (EKC)*
• *Cleanup of mix vessels*	—	—	*30 (m.)*	*3*	*< 0.1 – < 0.2*	*0.2*	*Oct 11,12,13,1993 (EKC)*
Full shift exposure for mix operator, involving							
manual additions and cleanups	*37*	*4*	*8 (h)*	*1*	*0.03*		*Oct 12,1993 (EKC)*

Using the data from columns 2 through 7, consult the *Quick Guide to OSHA Formaldehyde Requirements* to determine which requirements apply to you. See KODAK Publication No. J-113, *About the OSHA Formaldehyde Standard.*

KODAK PRODUCTS CONTAINING FORMALDEHYDE IN SOLUTION

KODAK Product	To Make	CAT No.	Formaldehyde Percent in Concentrate	Formaldehyde Percent in Working Solution
KODAK FLEXICOLOR Stabilizer and Replenisher	1 gallon 5 gallons 12 ½ gallons 75 gallons	174 9183* 169 3894* 174 9902* 180 5860*	12 37 37 37	<1 <1 <1 <1
KODAK FLEXICOLOR Stabilizer and Replenisher, Process C-41	1 gallon	190 0703	12	<1
KODAK FLEXICOLOR Stabilizer and Replenisher LF	5 litres 10 litres 12.5 gallons 50 gallons 52 gallons	125 0778 809 0532 832 0228 835 0167 126 3086	<0.1 <0.1 <0.1 <0.1 <0.1	<0.1 <0.1 <0.1 <0.1 <0.1
KODAK FLEXICOLOR Stabilizer II and Replenisher	75 gallons 10 litres	801 0308* 102 9883	2 2	<0.1 <0.1
KODAK FLEXICOLOR Stabilizer III and Replenisher, Process C-41	1 gallon 5 gallons 12.5 gallons 75 gallons	856 8792 196 5482 873 5599 143 2103	10 10 10 10	<0.1 <0.1 <0.1 <0.1
KODAK FLEXICOLOR AR Stabilizer III and Replenisher	5 gallons	848 7761	6	<0.1
KODAK FLEXICOLOR AR Stabilizer and Replenisher	5 gallons	159 7475*	9	<1
KODAK FLEXICOLOR AR Stabilizer and Replenisher Additive, Process C-41A	½ gallons	100 5768†	0.1 <1	—
KODAK HOBBY-PAC™ Color Negative Stabilizer	—	116 4037†	1–5	<0.1
KODAK Pre-Bleach and Replenisher, Process E-6	5 gallons	815 9840†	<0.1	<0.1
KODAK Stabilizer and Replenisher, Process E-6	5 gallons	127 8035†	25–30	<1
KODAK Pre-Bleach and Replenisher, Process E-6R	5 gallons	823 7828	<0.1	<0.1
KODAK Stabilizer and Replenisher, Process E-6AR, MX1600	5 gallons	122 7487	15	<0.5
KODAK EA-5 Prehardener and Replenisher, Part C	50 litres	848 7555†	21	<0.7
KODAK EA-5 Stabilizer and Replenisher	5 gallons	185 5501†	30	<0.2
KODAK VNF-1-1/RVNP Stabilizer and Replenisher	100 litres	191 7392	22	<1
KODAK ME-4/EOC-3 Prehardener and Replenisher, Part C	50 litres	190 2964†	25–30	1–5
KODAK Pre-Bleach, Process E-6‡	—	164 6058	<0.1	<0.1
KODALITH MPII Blender Concentrate, Solution No. 2‡	5 gallons	101 2103	<0.1	<0.1
KODALITH MPII Blender Concentrate, Solution No. 3‡	5 gallons	101 2202†	<0.1	<0.1
KODALITH Blender Concentrate, Solution No. 3‡	30 gallons 52 gallons	183 2583 184 2343	<0.1 <0.1	<0.1 <0.1
KODALITH MPII Blender Developer, Part A and Part B‡	12 gallons	127 5734	<0.1	<0.1
KODALITH MPII Blender Developer Replenisher, Part A and Part B‡	20 gallons	139 6506†	<0.1	<0.1
KODALITH Blender Concentrate, Solution No. 2‡	30 gallons 52 gallons	183 2302 133 3467	<0.1 <0.1	<0.1 <0.1
KODALITH Liquid Developer, Part A‡	20 gallons 40 gallons 52 gallons	126 8184 157 1900 820 5536	<0.1 <0.1 <0.1	<0.1 <0.1 <0.1

* To be discontinued
† Discontinued item.
‡ In contact with strong acids or strong bases, these solutions may liberate formaldehdye.

Workplace Exposure Summary Worksheet

STEP 1

Job Category: _____ **Work Area:** _____

STEP 2 Tasks and Procedures	Potential for Skin or Eye Contact?		Potential for Formaldehyde in Air?				Date and Source of Information
	STEP 3 Percent Formaldehyde		STEP 4	STEP 5	STEP 6	STEP 7	
	In Concentrate	In Working Solution	Duration of Task (h) (m)	Number of Samples	Air Concentration Range (ppm)	Maximum Air Concentration (ppm)	

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MORE INFORMATION

If you have environmental or safety questions about Kodak products or services, contact Kodak Environmental Services at 1-716-477-3194, between 8 a.m. and 5 p.m. (Eastern time) or visit KES on-line at www.kodak.com/go/kes.

Kodak also maintains a 24-hour health hotline to answer questions about the safe handling of photographic chemicals. If you need health-related information about Kodak products, call 1-716-722-5151.

For questions concerning the safe transportation of Kodak products, call Kodak Transportation Services at 1-716-722-2400.

Additional information is available on the Kodak website and through the U.S.A./Canada faxback systems.

The products and services described in this publication may not be available in all countries. In countries other than the U.S., contact your local Kodak representative, or your usual supplier of Kodak products.

The following publications are available from Kodak Customer Service or from dealers who sell Kodak products.

J-110	*Formaldehyde in Photographic Processing Facilities*
J-111	*Determining Workplace Exposure to Formaldehyde*
J-112	*Formaldehyde Emergencies*
J-113	*About the OSHA Formaldehyde Standard*
J-114	*Formaldehyde Training*
J-115	*Formaldehyde Information*
J-311	*Hazard Communication for Photographic Processing Facilities*
J-316	*Emergency Preparedness for Photographic Processing Facilities*

For more information about Kodak Environmental Services, visit Kodak on-line at:
www.kodak.com/go/kes

Many technical support publications for Kodak products can be sent to your fax machine from the Kodak Information Center. Call:
U.S. 1-800-242-2424, Ext. 33 / Canada 1-800-295-5531
—Available 24 hours a day, 7 days a week—

If you have questions about Kodak products, call Kodak.
In the U.S.A.:
1-800-242-2424, Ext. 19, Monday–Friday
9 a.m.–7 p.m. (Eastern time)
In Canada:
1-800-465-6325, Monday–Friday
8 a.m.–5 p.m. (Eastern time)

This publication is intended to assist managers of photographic processing facilities in their compliance requirements under the OSHA Formaldehyde Standard. Additional local and state requirements may also apply. Verify the specific requirements for your facility with your legal counsel.

EASTMAN KODAK COMPANY • ROCHESTER, NY 14650

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