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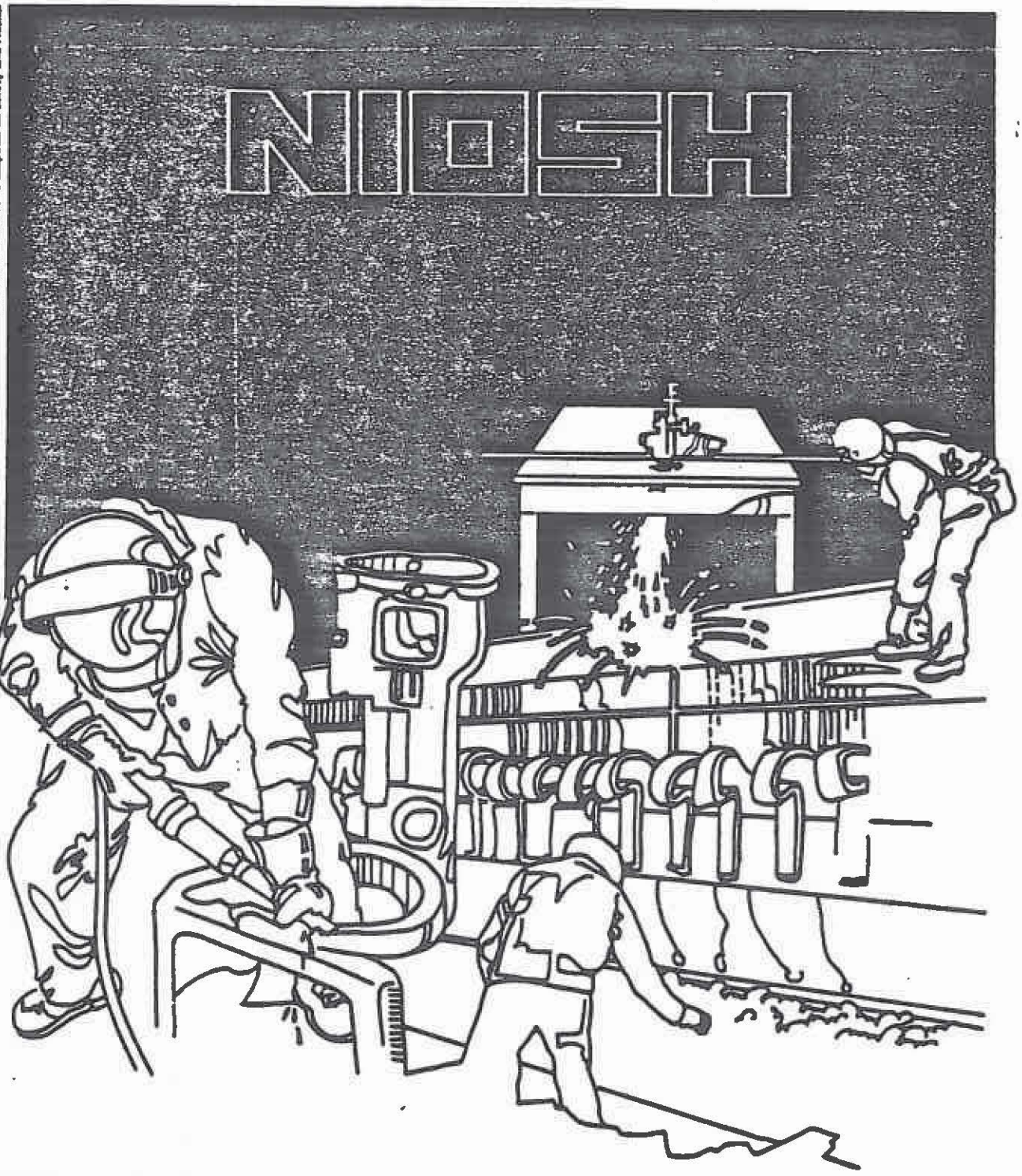

Health Hazard Evaluation Report

HETA 85-085-1615
WYOMING HIGH SCHOOL
WYOMING, OHIO

HETA 85-085-1615
AUGUST 1985
WYOMING HIGH SCHOOL
WYOMING, OHIO

NIOSH INVESTIGATOR:
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I. SUMMARY

On November 28, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate chemical exposures of students and teachers in the art department at Wyoming High School, Wyoming, Ohio. While conducting this investigation, a subsequent request was received to evaluate formaldehyde exposures in two biology rooms.

NIOSH investigators visited the school on January 9, 1985 to collect information on chemicals used and class schedules. A follow-up survey was conducted to collect air samples for metals, organic solvents, inorganic fluorides, and crystalline silica on February 5 and 7, 1985 in the art department. Air samples for formaldehyde were collected on February 7, 1985 in the biology rooms.

Air concentrations for lead were detected on two of four personal samples at 8.4 and 8.9 ug/m^3. Cadmimum was detected on one of four personal samples at 1.1 ug/m^3.

Air concentrations for inorganic fluorides ranged from 14.2 to 61 ug/m^3 on four area samples. One settled room dust sample contained 16.7% quartz. Bulk samples of some art supplies contained high percentages of lead (20 and 42.5%) and low percentages of arsenic (0.03 and 0.05%) and cobalt (0.03%).

Hexane was the only organic solvent detected on personal airborne samples. Concentrations were below 2 ppm on four full-shift samples and below 6 ppm on two short-term samples.

Formaldehyde was not detected on any short-term (30 minute) or full shift samples (all values <1.5 ppm) collected with sorbent tubes, but ranged from 0.3 to 7 ppm on direct-reading colorimetric indicator tubes. This discrepancy between sorbent tubes and indicator tubes was difficult to explain, but subsequent laboratory tests suggest that the indicator tube values were high and that the sorbent tube values were more accurate. Both NIOSH investigators experienced eye irritation and detected the characteristic formaldehyde odor while animal dissections were ongoing. We had intended to return and conduct additional formaldehyde sampling but were unable to because animal dissections ceased earlier than anticipated.

Warning labels on most art supplies were inadequate and the school had no material safety data sheets for any of the supplies.

Based on the results of this investigation the NIOSH investigators believe that a health hazard did exist from exposure to formaldehyde in the biology rooms during animal dissection and that a potential hazard exists in the art department due to lead, arsenic, and crystalline silica in raw materials/settled room dust. Recommendations for improving conditions are made in Section VIII of this report.

KEYWORDS: SIC 8210 (Elementary and Secondary Schools), high school, art-hazards, lead, arsenic, quartz, hexane, anatomy labs, formaldehyde.

II. INTRODUCTION

On November 28, 1984 the National Institute for Occupational Safety and Health (NIOSH) received a request from the principal of Wyoming High School, Wyoming, Ohio for an assessment of the exposure to chemical agents of two teachers and over 100 students in the school's art department. During the evaluation of the art department, a request was received simultaneously from the principal and a biology teacher for an assessment of formaldehyde exposures during anatomy classes in the school's biology rooms.

NIOSH investigators made an initial site visit on January 9, 1985 to obtain background information. A follow-up survey was conducted on February 5 and 7, 1985. A second follow-up survey to conduct a further assessment of formaldehyde exposures was cancelled because the animal dissections were completed earlier than anticipated.

Environmental results and corresponding recommendations were forwarded by letter and/or telephone in January, February, and April 1985, to all concerned parties.

III. BACKGROUND

Wyoming High School provides secondary education for approximately 550 freshman through senior students. The class schedules include eight periods, each about 40 minutes long.

The art department is divided so that one teacher covers drawing, painting, printmaking, etc. and the second teacher covers ceramics, pottery, jewlery, photography, etc. Class sizes range from five to 25 students each. Potential hazards vary depending on the specific art class and corresponding supplies used. For example, rubber cement used for gluing contains hexane. Some ceramic glazes used in pottery making contain lead. Enamel paints used to make certain types of jewelry contain metals which could include lead and arsenic. Some soldering fluxes contain fluorides.

The anatomy classes are conducted in two rooms which are used during seven of the eight class periods. The anatomy classes include beginning through advanced dissection of earthworms, pigs, cats, and sheep brains. The specimens preserved with formaldehyde are the source of the formaldehyde exposure. Each room contains 14-15 tables with students normally working in teams of two. The number of students range from two to 30 with most classes having about 20 students. One teacher is in the area all day and two teachers spend 1/2 day each in the area. Advanced students spend extra time on dissection so that they may be in the area 2-3 hours per day.

IV. METHODS

Due to the variety of art classes and thus supplies used, we decided to assess both existing and potential hazards. Existing hazards were assessed by collecting personal and area airborne samples using the specified collection media for the contaminant of interest. The collection media was attached via flexible tubing to a battery operated pump calibrated at a known flow rate (Table 1). Grab samples were also collected for some materials to determine the airborne concentration at a specific time using direct-reading colorimetric indicator tubes. Samples were collected to assess airborne concentrations of metals, crystalline silica, fluorides, solvents, hexane, and acetic acid.

For assessing potential hazards, bulk samples of ceramic glazes, pottery waste, and various paints were collected in glass vials and analyzed for metals and/or crystalline silica.

Table I lists the sampling and analytical techniques used and the corresponding references.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards.[1-10] Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet only those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

It should be noted that the aforementioned criteria are intended for industrial populations and as such may not be suitable for teacher/student groups. The occupational exposure criteria will be used for comparison purposes, as they do serve as reference points. Occupational exposure criteria and corresponding health effects are listed in Table 2.

VI. RESULTS

Table 3 presents the airborne concentrations for formaldehyde collected in the biology rooms, using short-term, full shift, and grab samples. No formaldehyde was detected on the short-term or full shift samples; all values were less than 1.11 parts formaldehyde per million parts of air (ppm). However, grab samples collected with indicator tubes ranged from 0.5 to 7 ppm in the biology rooms and 0.3 ppm in the hallway. We believe formaldehyde was present based on the fact that dissection specimens had been preserved with it, eye irritation was experienced by class members and ourselves, and by the characteristic formaldehyde odor we detected. It was not possible to determine what the exact levels were since the indicator tubes are generally considered to be screening devices. The sorbent tubes we used were about 2 years old (these were the only tubes available) and could have lost their reactivity.

In a subsequent attempt to determine which tubes were more accurate we conducted four side-by-side tests using sorbent tubes, and formaldehyde indicator tubes in a formaldehyde vapor generation system. For each test we used four (two old and two new) sorbent tubes and five to 9 indicator tubes. The old and new sorbent tubes produced nearly identical values in all four tests (Table 4) while the average value for detector tubes were 2-3 times higher. Based on these results and the previous experience of other investigators with both types of tubes, we believe the detector tube values in Table 3 are high and that the actual formaldehyde values, as indicated by the sorbent tube data were at or below 1 ppm.[11-13]

Any exposure to formaldehyde could be hazardous based on its potential carcinogenic activity. NIOSH stated in a 1981 Current Intelligence Bulletin that, based on laboratory studies in which formaldehyde induced nasal cancer in rats, it should be considered a cancer risk to humans. Therefore, exposures should be minimized to the extent feasible.[10]

Table 5 presents the results of air sampling for metals in the art department. Two metals (lead, cadmium) were detected on at least one of the eight samples collected. The highest concentrations of both metals were obtained on one art teacher, at 8.9 ug/m^3 for lead and 1.1 ug/m^3 for cadmium. All values are well below current occupational criteria.

Table 6 presents the results of analysis for metals in some of the art supplies. Arsenic, lead, copper, cobalt and iron were all detected in at least one sample. Lead was detected in five of six bulk samples and ranged up to 42.5%. The other metals were found at relatively low percentages, however it should be noted that arsenic, although at low amounts in the bulk samples, has very low exposure criteria (NIOSH = 2 ug/m^3, OSHA = 10 ug/m^3). Thus it would not require much airborne arsenic for a person to be exposed at or above the limits.

Table 7 presents the results of airborne sampling for fluorides and crystalline silica in the art department. Air concentrations for fluorides ranged from 14.2 to 61 ug/m^3 on four area samples. Quartz was detected on one area sample which was actually an activated sample of the room dust from the pottery/ceramic area. The percent of quartz found on this sample (16.7%) is high and could result in excessive exposure if the settled dust were disturbed via class activities.

Table 8 presents the results of personal airborne sampling for organic solvents in the art department. Hexane concentrations ranged from below the laboratory limit of detection (0.01 mg/sample) to 6.01 mg/m^3 which is equal to 1.57 ppm on four full-shift samples and 4.35 and 5.42 ppm on two short-term samples. All samples are well below current exposure criteria, the lowest of which is 50 ppm (ACGIH) for full-shift samples and 510 ppm (NIOSH) for short-term samples.

General Observations

One of the art teachers was pregnant and concerned about potential fetal damage. Fortunately she was already reducing her exposures when feasible. We provided her with information on chemicals known to be of specific concern (i.e., lead).

Based on our observations we believe the teachers in the art and biology departments are at greater risk than the students, who spent less time in any specific room. Students who had multiple biology/art classes or who worked in these areas during their study periods, might be in a room 2 or 3 classes (about 2 hours). Teachers on the other hand spent up to 8 periods in a specific room (about 6 hours).

The art teachers are responsible for various classes with most classes using different supplies. Thus, exposure to most chemicals last less than one hour. Exceptions to this include hexane from the rubber cement used in many of the art classes, and quartz and/or lead which may be in the art supplies or in settled room dust (Table 5).

A disturbing aspect of the evaluation was the inadequate labels found on the art supplies. For example, the ceramic glaze that contained 42.5% lead had a statement that read, "Caution: harmful if swallowed, may contain silicious or other toxic materials. Do not take internally". The label should have included a statement that the material contained a high percentage of lead, etc. and provided information on proper protective measures.

Two bulk samples of enamel paint contained 3.3 and 5.4% lead and low percentages of arsenic. These materials had no warning labels at all. The enamel paints are in powder form and as such are potentially more hazardous than the glazes which have a wet, thick consistency. Proper warning labels in combination with supporting literature (i.e., MSDS's, technical data sheets) would help insure that unnecessary exposure are avoided.

Local exhaust ventilation hoods had recently been installed on two buffing/grinding stations in the art department. The hood at each station was basically a rectangular box with screened exhaust ports for each of the two wheels per station. Waste material accumulated on each screen but even heavy build-ups had no noticeable effect on face velocities measured at the front of each wheel. Face velocities were 500-600 feet per minute (fpm) at the station on the left (as you face the grinders) and 200-350 fpm at the right station. The original filters were still in place and appeared to be approaching an overload status.

VII. DISCUSSION AND CONCLUSION

Based on these results, the NIOSH investigators believe a hazard existed for teachers and students due to formaldehyde exposure during animal dissection classes. Additionally, a potential hazard existed due to the presence of lead, arsenic, quartz, etc. in art supplies.

NIOSH has conducted previous studies of exposures to formaldehyde and art supplies in similar working environments.[14-20] Personal exposures varied from nondetected to concentrations in excess of current occupational criteria for materials such as lead.

The U.S. Consumer Product Safety Commission had conducted studies and/or compiled publications concerning health hazards in schools including one discussing exposure to formaldehyde from preserved specimens.[21-22] One of these publications discusses the emerging use of "new-technology, low-formaldehyde specimens". The commission estimates that over 7 million students are exposed to preserved specimens each year. They also report that air levels of formaldehyde in students breathing zones were reduced when formaldehyde preserved animals were replaced with low-formaldehyde specimens and when formaldehyde preserved specimens were thoroughly washed before initial use.[22] Other investigators have written articles discussing specific hazards for artists.[23-27]

These references are useful sources of information concerning the potential hazards associated with exposures to formaldehyde and art chemicals. Copies of these have been forwarded to appropriate personnel at Wyoming High School.

VIII. RECOMMENDATIONS

1. Airborne concentrations of formaldehyde during animal dissection should be reduced. The best solution would be to replace formaldehyde (formalin) preserved lab animals with freeze-dried or animals preserved with less formaldehyde. Local exhaust engineering is an alternative but would be less desirable based on building layout, maintenance requirements and economics.

2. If any formaldehyde preserved animals are used, they should be thoroughly washed and the original shipping bag replaced with a clean plastic bag.

3. Students should be instructed to keep their nose/mouth as far from the animals as possible to reduce the amount of formaldehyde they breath.

4. Everyone handling preserved animals should wear protective gloves to reduce skin contact.

5. Art supply manufacturers should improve their labels and supporting documentation so that teachers and students are aware of the potential hazards.

6. Material safety data sheets and/or product information sheets should be obtained for all chemicals used in the art department.

7. Filters on the buffing/grinding wheels should be replaced periodically (i.e., once every quarter).

8. The entire art department should be kept as clean as possible to reduce the potential hazard from chemicals (i.e., quartz) in settled dust.

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Principal, Wyoming High School
2. Teachers, Wyoming High School
3. NIOSH, Region V
4. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table 1

Sampling and Analytical Techniques

Wyoming High School
Wyoming, Ohio
HETA 85-085

Material	Flow Rate (Lpm)	Collection Media	Analytical Technique	References
Metals -				
Airborne sample (As, Pb, Cd, Cr, Ni)	1.5	Mixed cellulose ester membrane filter (AA)	NIOSH Method 7901 for As NIOSH Method 173 for Pb, Cd, Cr, Ni	28, 29
Bulk screening	-	Glass vial	Inductively coupled plasma atomic emission spectroscopy	
Formaldehyde -				
A. Short-term and full shift	0.02 - 0.05	ORBO-22-Tube	NIOSH Method 354 (modified)	30, 32
B. Grab sample	-	Indicator tube and pump	Direct reading	
Fluorides		AA filter with Na_2CO_3 treated back-up pad	NIOSH Method 7902 (modified)	29
Quartz -				
Bulk material sample	-	Glass vial	X-ray powder diffraction	
Airborne sample	1.7	PVC filter in 10 mm cyclone	NIOSH Method 7500 (modified)	33
Organic Solvents (i.e., hexane)		Charcoal tube		
Hexane grab sample	-	Indicator tube and pump	Direct reading	32

Table 2

Summary of Occupational Exposure Criteria
and Associated Health Effects

Wyoming High School
Wyoming, Ohio
HETA 85-085

Material	Exposure Criteria* NIOSH	OSHA	ACGIH	Health Effects (associated with this material)	References
Lead	50 ug/m^3	50 ug/m^3	150 ug/m^3	constipation, colic, abdominal pain, anemia, insomia, effects to fetus	4,5,31
Cadmium	40 ug/m^3	200 ug/m^3	50 ug/m^3	pulmonary edema, respiratory symptoms, nausea, diarrhea, anemia	4,8,31
Flucrides	2.5 ug/m^3	2.5 ug/m^3	2.5 mg/m^3	mucous membrane irritation, nausea, bone calcification, diarrhea, abdominal pain	4,6,31
Quartz	50 ug/m^3	$\frac{10\ mg/m^3}{\%\ Q + 2}$	$\frac{10\ mg/m^3}{\%\ Q + 2}$	cough, dyspnea, wheezing, impaired pulmonary function	4,9,31
Hexane	100 ppm 510 ppm***	500 ppm	50 ppm	nausea, headache, eye and nasal irritation, muscle weakness, chemical pneumonia	4,31
Formaldehyde	Lowest** Feasible Limit	3 ppm	2 ppm***		4,10,31

Note: OSHA and ACGIH hexane criteria is for the normal isomer while the NIOSH criteria is for all hexane isomers.

ug/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter
ppm = parts per million

Q = Quartz (only polymorph of crystalline silica found in any samples).
* For 8-10 hour exposure unless otherwise indicated
** Potential occupational carcinogen
*** Ceiling limit

Table 3

Formaldehyde, Personal Samples
Grab, Short-Term, and Full Shift Formaldehyde Samples

Wyoming High School
Wyoming, Ohio
HETA 85-085

February 7, 1985

Sample Number	Location/Job	Sample Time	Volume (Liters)	Sample Type	Concentration (ppm)
F-3	NIOSH I.H. observation of activities	830-1450	6.97	FS	ND (<0.23)
F-2	Teacher 1	945-1015	1.52	ST	ND (<1.07)
F-7	Teacher 1	1421-1450	1.47	ST	ND (<1.11)
F-1	Teacher 2	0855-0925	1.56	ST	ND (<1.05)
F-4	Teacher 2	0945-1015	1.58	ST	ND (<1.03)
F-5	Teacher 3	1125-1155	1.48	ST	ND (<1.11)
F-6	Student	1421-1450	1.47	ST	ND (<0.99)
*	Biology Room 1, cat dissection	850	-	AG	2
*	Biology Room 2, earthworm dissection	905	-	AG	0.5
*	Biology Room 1, pig dissection (12 pigs)	942	-	AG	4
*	Biology Room 1, pig dissection (12 pigs)	1010	-	AG	4
*	Biology Room 2, sheep brain dissection	1124	-	AG	1
*	Biology Room 1, dissection of fetal pig, breathing zone sample	1150	-	AG	1.5

(Continued)

Table 3 (Cont.)

Sample Number	Location/Job	Sample Time	Volume (Liters)	Sample Type	Concentration (ppm)
*	Biology Room 1, cat dissection, breathing zone sample	1257	-	AG	7
*	Biology Room 1, cat dissection, breathing zone sample	1337	-	AG	7
*	Biology Room 1, cat dissection, breathing zone sample	1425	-	AG	7
*	In Hallway, 15' from biology rooms	1433	-	AG	0.3

FS = Full Shift
ST = Short-Term (30 minute sample)
AG = Area Grab Sample, collected with direct reading indicator tubes.
ND = Not detected on this sample. The value in parenthesis represents the upper limit for that sample, determined by dividing the limit of detection by the volume (m^3) for each specific sample.
* = No sample number assigned for indicator tube samples.
- = Not applicable

Table 4

Formaldehyde Laboratory Test
Side-by-Side Evaluation of Sorbent Tubes and Direct-Reading Indicator Tubes

Wyoming High School
Wyoming, Ohio
HETA 85-085
May 16-17, 1985

Test Number	Sorbent Tube Test					Corresponding Indicator Tube Value in PPM ($\bar{X}$ = average value) (n = number of samples)
	Tube Number	Liters	mg/tube	mg/m^3 =	ppm	
1	501	4.6	.012	2.61	2.13	$\bar{X}$=6 (n=6)
	601	4.6	.012	2.61	2.13	
	502	4.6	.012	2.61	2.13	
	602	4.6	.013	2.83	2.30	
2	503	4.6	.008	1.74	1.42	$\bar{X}$=3.5 (n=5)
	603	4.6	.008	1.74	1.42	
	504	4.6	.008	1.74	1.42	
	604	4.6	.007	1.52	1.24	
3	506	7.5	.016	2.13	1.74	$\bar{X}$=4.8 (n=9)
	606	7.5	.017	2.27	1.85	
	507	7.5	.016	2.13	1.74	
	607	7.5	.019	2.53	2.06	
4	508	7.5	.005	0.67	0.54	$\bar{X}$=1.5 (n=7)
	608	7.5	.007	0.93	0.76	
	509	7.5	.007	0.93	0.76	
	609	7.5	.007	0.93	0.76	
Field Blanks	511	-	<.002			
	611	-	<.002			
	512	-	<.002			
	612	-	<.002			
	513	-	<.002			
	613	-	<.002			
	510	-	<.002			
	610	-	<.002			

500 Number = Old Tubes (ORBO 22, Lot #492-25)
600 Number = New Tubes (ORBO 22, Lot #492-82)

Table 5

Airborne Concentrations of Metals
Personal and Area Samples

Wyoming High School
Wyoming, Ohio
HETA 85-085

February 5 and 7, 1985

Sample Number	Location Job	Date	Sample Time	Volume (Liters)	Sample Type	Metals Concentration (ug/m^3)	
						Lead	Cadmium
M-2	Art Teacher 1	2/5	0747-1502	653	P	ND (<3.1)	ND (<0.77)
M-8	Art Teacher 1	2/7	0741-1508	656	P	ND (<3)	ND (<0.76)
M-3	Art Teacher 2	2/5	812-1100 1130-1457	563	P	8.9	1.1
M-9	Art Teacher 2	2/7	847-1103 1148-1450	477	P	8.4	ND (<1)
M-4	Next to solder table; 6' above floor	2/5	0755-1514	659	A	6.1	ND (<0.76)
M-11	Next to solder table; 6' above floor	2/7	0757-1500	635	A	6.3	ND (<0.79)
M-1	Behind electric ceramic kiln	2/5	0930-1513	515	A	ND (<3.9)	ND (<0.97)
M-7	Behind electric ceramic kiln	2/7	0802-1504	633	A	ND (<3.2)	ND (<0.79)

Note: Arsenic, chromium, and nickel were all below the limit of detection on these samples, LOD = As 0.2 ug/filter, Cr = 1 ug/filter.

P = Personal Sample
A = Area Sample
ND = Not detected on this sample. The value in parenthesis represents the upper limit for that sample, determined by dividing the limit of detection by the volume (m^3) for each specific sample.

Table 6

Percentages of Metals and Quartz in Bulk Samples
Art Department Chemicals

Wyoming High School
Wyoming, Ohio
HETA 85-085

Sample Number	Type of Material	% of Various Metals					
		As	Pb	Cu	Co	Fe	Quartz
B-10	Ceramic Glaze	<0.01	>20	<0.01	<0.01	0.02	-
B-11	Ceramic Glaze - Under Glaze	<0.01	0.03	<0.01	0.03	0.01	-
B-12	Enamel Paint	0.05	3.32	<0.01	<0.01	<0.01	-
B-13	Enamel Paint	0.03	5.35	1.38	<0.01	0.09	-
B-1	Pottery Waste	<0.01	<0.01	<0.01	<0.01	0.97	40-60%
B-2	Ceramic Glaze	<0.01	42.5	<0.01	<0.01	0.04	*

As = arsenic, Pb = lead, Cu = copper, Co = cobalt, Fe = iron.

- = Not evaluated in this sample

* No polymorphs of crystalline silica were detected but amorphous materials were found.

Note: Metals analysis evaluated percent of 31 metals. Beryllium, selenium, and cadmium were not detected in any sample; limit of detection = 0.01%.

Table 7

Airborne Concentrations of Fluorides and Crystalline Silica
Area and Personal Samples

Wyoming High School
Wyoming, Ohio
HETA 85-085

February 5 and 7, 1985

Sample Number	Location/Job	Date	Sample Time	Volume (Liters)	Sample Type	Concentration (mg/m^3)	Quartz
F-1	Next to solder table; 6' above floor	2/5	0819-1514	311	F/A	61	-
F-6	Next to solder table; 6' above floor	2/7	0757-1500	423	F/A	21.3	-
F-3	Behind electric ceramic kiln	2/5	0930-1513	257	F/A	19.5	-
F-2	Behind electric ceramic kiln	2/7	0802-1504	422	F/A	14.2	-
FB-3949	NIOSH I.H.	2/5	0750-1445	706	S/P	128	ND
FB-3945	Pottery area, sample ran 2 days	2/5 & 2/7	0755-1508 0743-1520	1780	S/A	39	ND
FB-3947	Pottery area; different locations	2/7	1102-1520	439	S/A	*	16.7%

* This sample was "activated" by disturbing settled dust in the area through fanning actions. Thus dust concentration not reported. Intent of sample was determination of crystalline silica content.

- = Not evaluated in this sample.

ND = Not detected on this sample.

Note: Concentrations of fluorides are particulate, no gase fluorides were detected on any sample.

F/A = Fluoride/Area
S/P = Silica/Personal
S/A = Silica/Area

Table 8

Airborne Concentrations of Solvents
Personal Samples

Wyoming High School
Wyoming, Ohio
HETA 85-085

February 5 and 7, 1985

Sample Number	Location/Job	Date	Sample Time	Volume (Liters)	Sample Type	Concentration Hexane	
						$\frac{mg/m^3}{6.01}$	$\frac{ppm}{1.57}$
C-4	Art Teacher 1	2/5	0747-1502	9.92	P/FS		
C-20	Art Teacher 1	2/7	0741-1508	9.17	P/FS	ND	ND
C-1	Art Teacher 2	2/5	0812-1100 1130-1457	4.58*	P/FS	ND	ND
C-21	NIOSH I.H.	2/7	0747-1457	9.68	P/FS	1.03	0.30
C-3	NIOSH I.H.	2/5	1219-1234	3.19	P/ST	15.7	4.35
C-5	Art Teacher 1	2/5	1423-1438	3.06	P/ST	19.5	5.42

Note: Cyclohexane, heptane, toluene, xylenes, and ethyl benzene were detected on at least one high volume area sample but below the laboratory limit of detection (0.01 mg/sample) on all personal samples.

P/FS = Personal Full Shift Sample
P/ST = Personal Short-Term Sample

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