June 30, 1997

Dear MASMS member:

The attached question and answer guide was developed by the MASMS Health & Safety committee to assist school districts in complying with the MN Employee Right-To-Know (ERK) standard. A survey of MASMS members indicated many differences in how the standard was being interpreted. Please forward this information to the ERK Coordinator for your district.

The questions used to create this document were submitted by MASMS members, and the answers were reviewed by OSHA for accuracy. Even though all school districts are not exactly alike, the guide should help clarify how the ERK standard applies to common situations found in schools.

In general, OSHA representatives agreed that administrative/clerical employees, as well as most elementary and general education secondary teachers are not normally exposed to materials other than "consumer use products" which are exempt, and would not need to be trained.

OSHA also does not require that every employee be trained, only those having routine exposure to hazards covered by the standard. The Exposure Assessment Guide in Appendix A was provided to illustrate the employee groups that are likely to be covered under the three main categories of the standard. The Health & Safety Training Curriculum in Appendix C was included to show how ERK training fits in with other OSHA required training. Specific job duties and products will vary and will need to be evaluated by each district.

Hazardous substance exposures can come from processes as well as products. Exposures to lead, carbon monoxide, welding fumes, and wood dust can all occur in schools. Information regarding these hazards must be provided to employees who are routinely exposed, similar to providing an MSDS for a product containing hazardous chemicals. Information on each of these hazards was prepared by OSHA and has been included in the appendix section of this document.

Many of the answers found in this guide came directly from the MNOSHA "Enforcement Guidelines for the Employee Right-To-Know Standard" document which has been included as Appendix D. You are encouraged to review this document carefully for issues not addressed in this guide.

You will have an opportunity to ask additional questions about this guide at the "Save Money on Staff Training" workshop to be held during the MASMS Convention and Trade Show in St. Cloud. The workshop will be from 10:10 AM to 11:00 AM on October 2, 1997. The workshop will be presented by Dean Olsen, Osseo I.S.D. 279, and Rodger Schaefbauer, Wayzata I.S.D. 284, who represented MASMS during all of the meetings with MNOSHA to develop this document.

Employee Right-To-Know

A Question & Answer Guide For Minnesota School Districts

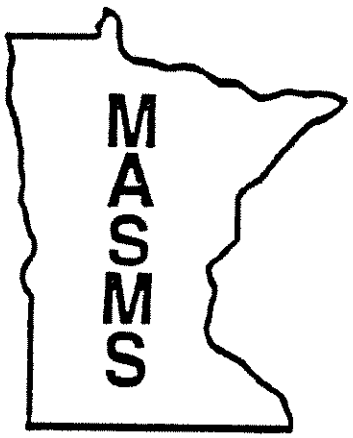
Minnesota Rules Chapter 5206
MN Department of Labor and Industry

A Collaborative Project of:

Minnesota Association of School Maintenance Supervisors
Minnesota Department of Labor and Industry

April, 1997

HEALTH AND SAFETY



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A professional organization committed to promoting excellence in the operation and care of educational facilities.

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Minnesota Association of School Maintenance Supervisors

Minnesota Association of School Maintenance Supervisors

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MASMS Voice Mailbox: (612-)484-5159 Additional health and safety information is available on request.

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Disclaimer

The agencies and organizations involved in the development of this question and answer guide have attempted to answer the most frequently asked questions that school districts have regarding the implementation of an Employee Right-To-Know Plan. This is not intended to be a substitute for the actual regulation, nor is it intended to be a comprehensive guide. It is the sole responsibility of each school district to comply with the OSHA standard. Interpretations of the standard do vary. For further direction, you are encouraged to call the MN OSHA consultation office. Judgement as to the suitability of the information provided in this guide is the sole responsibility of the user. If legal or regulatory advisors or expert assistance is required, the services of a competent professional or regulatory agency should be sought.

1. **Which employees are covered by the MN Employee Right-To-Know (ERK) Standard?**

   The Standard requires that each employer evaluate their workplace for the existence of hazardous substances, harmful physical agents and infectious agents. Employees who are "routinely exposed" to those substances or agents must be provided with information, training, and personal protective equipment (gloves, goggles, etc.) for the hazards they are exposed to. This includes all full-time, part-time, seasonal, and temporary employees. Volunteers who receive no form of compensation are not technically "employees" and would not be covered under the Standard.

2. **What does "routinely exposed" mean?**

   "Routinely exposed" means that a reasonable potential for exposure exists during the normal course of an employee's assigned work. This includes their routine duties and any direct responsibilities they have for cleaning up leaks and spills during an emergency. It does not include a simple walk-through of an area where a substance or agent is present and no significant exposure occurs.

3. **What is the definition of a "hazardous substance" under the MN ERK Standard?**

   The MN ERK Standard defines "hazardous substances" to include those items listed in 5206.0400 and any other substances that exhibit one or more of the following characteristics:

   Health Hazard - toxic, highly toxic, irritant, strong sensitizer, a carcinogen, a teratogen, a mutagen, a reproductive toxic agent, or for which there is generally accepted medical or scientific evidence that substantial acute or chronic personal injury or illness, during or as a direct result of, any customary or reasonably foreseeable accidental or intentional exposure will occur.

   Physical Hazard - combustible, flammable, extremely flammable, corrosive, reactive, pyrophoric (ignites spontaneously), pressure generating (compressed gases), etc.

4. **What types of products are exempt from the "hazardous substance" category?**

   a. Products intended for personal consumption by employees in the workplace.
   b. Consumer products packaged for distribution to, and used by, the general public, including any product used by an employer or the employer's employees in the same form, concentration, and manner as it is sold to consumers, and to the employer's knowledge, employee exposure is not significantly greater than the consumer exposure occurring during principal consumer use of the product.
   c. Any article, including but not limited to an item of equipment or hardware, which contains a hazardous substance, if the substance is present in a solid form which does not create a health hazard as a result of being handled by the employee.

d. Any hazardous substance that is bound and not released under normal conditions or work, or in a reasonably foreseeable occurrence resulting from workplace operations.
e. Products sold or used in retail food sale establishments and all other retail trade establishments, exclusive of processing and repair work areas.
f. Any waste material regulated pursuant to the federal Resource Conservation and Recovery Act, Public Law Number 94-580, but only with respect to any employer in a business which provides a service of collection, processing, or disposal of such waste.
g. Waste products labeled pursuant to the Resource Conservation and Recovery Act. If hazardous substances make up the waste product, the employer must assure that mixing of incompatible substances does not occur.
h. Any substance received by an employer in a sealed package and subsequently sold or transferred in that package, if the seal remains intact while the substance is in the employer's workplace.
i. Any substance, mixture, or product if present in a physical state, volume, or mixture concentration for which there is no valid and substantial evidence that a significant risk to human health may occur from exposure.
j. "Liquor" as defined in Minnesota Statutes, section 340.07, subdivision 2, or "nonintoxicating malt liquor" as defined in Minnesota Statutes, section 340.001, subd. 2.
k. "Food" as defined in the Federal Food, Drug, and Cosmetic Act, United States Code, title 27, section 321, et seq.

5. What is considered a "harmful physical agent" under the MN ERK Standard?

MN OSHA considers "harmful physical agents" to include the following items:

a. Heat.
b. Noise.
c. Ionizing radiation.
d. Non-ionizing radiation.

Where there is a reasonably foreseeable potential for exposure to one or more of these physical agents at a level which may be expected to approximate or exceed the permissible exposure limit or the applicable action level, the employer must provide training to employees as required in part 5206.0700. Reference question 7(b) for exemptions.

6. What is considered an "infectious agent" under the MN ERK Standard?

MN OSHA considers "infectious agents" to include communicable bacterium, rickettsia, parasites, virus, or fungus determined by the commissioner by rule, with approval of the commissioner of health, which according to documented medical or scientific evidence

causes substantial acute or chronic illness or permanent disability as a foreseeable and direct result of any routine exposure to the infectious agent. A list of covered infectious agents is included in the standard.

7. **How does a school district evaluate their workplace for the existence of hazardous substances, harmful physical agents, and infectious agents?**

   This will vary somewhat from district to district. Refer to Appendix A for an example of the employee groups found to have routine exposure within a specific school district, based on individual responsibilities. Each district will need to conduct their own evaluation, but this format may be helpful. Some important components of the assessment include:

   a. **Hazardous substances** - Conduct an inventory of products used in the district that contain hazardous substances or have hazardous physical characteristics. The evaluation can be completed using a combination of physical inventories, purchasing records, etc. Some commonly omitted hazards include: welding fumes, soldering fumes, carbon monoxide in areas where there is a combustion source, wood dust, etc. Refer to Appendices E, F, G, H and I for reference materials that can be used to train employees who are routinely exposed. Employees who are exposed to these "hazardous substances" need to be identified so that they can be provided with the proper training, information and personal protective equipment.

      If employees are only exposed to items that would be considered "consumer products" (see exemption in question 4), the employer will need to determine if the products are used in the same form, concentration and manner as a consumer would use them. If the products are used more frequently, for example, and therefore pose a substantially greater exposure, they would not be exempt.

   b. **Harmful physical agents**

      Heat - Heat related health problems include heat stroke, heat exhaustion, heat cramps, fainting, and heat rash. For indoor work areas, MN OSHA refers to the "Workroom Ventilation and Temperature" chart located in section 5205.0110. If the effective temperature limit is approached or exceeded, training should be provided for employees who will be working for extended periods of time in these areas. Employees who simply walk through a hot area would not require training. Areas to evaluate might include boiler rooms, mechanical areas, laundry rooms, kitchens, kiln rooms, etc. Even though employees working outdoors (maintenance and grounds crews, lifeguards, etc.) are not directly covered by the table found in section 5205.0110, they can also be exposed to extreme heat during the summer, and training is recommended. Examples of employee training would include: identification and cause of heat disorders, symptoms of over-exposure, how to treat heat stress/stroke and preventative measures that can be taken to avoid over-exposure.

The MN ERK Standard requires training for exposures to noise levels that approximate or exceed the 8-hour action level of 85dB. Even short-term exposures to some loud pieces of equipment or machinery can exceed the 8-hour action level. Refer to Appendix B for permissible exposure levels, action levels and other pertinent information.

Since the Hearing Conservation Standard (1910.95) also has training requirements that are mandatory at this level, additional or duplicate training under the MN ERK Standard is not required. Refer to Appendix C for an illustration of how the Hearing Conservation required training supersedes the training requirements under MN ERK.

Ionizing radiation - Exposure to ionizing radiation in a school is highly unlikely. Some of the most common uses of ionizing radiation occur in hospitals and dental offices with X-ray equipment, and in general industry with non-destructive testing.

Non-ionizing radiation - Exposure to non-ionizing radiation in a school is also unlikely. Possible sources of non-ionizing radiation include lasers used in construction, radio frequency (RF) microwave heaters, and communications systems. Typically, microwave ovens would not exceed OSHA's exposure limits.

c. **Infectious agents** - Conduct an evaluation to determine which employees in the district have routine exposure to body fluids through first aid, cleaning, or hygiene-related activities that are required as part of their job. This would include routine exposure to all body fluids other than perspiration (including feces, urine, sputum, menstrual discharges, saliva, etc.). This may include individuals that are not covered by the Bloodborne Pathogen Standard (e.g. if diapering was their only source of exposure).

8. **Would a newly hired employee who has received ERK training from a his/her past employer within the last year need to be completely retrained?**

District specific information including labeling procedures, MSDS locations, personal protective equipment and designation of the ERK Coordinator would need to be provided. Since the current employer will be held responsible for the employee's competency, it may be easier to just re-train them, rather than evaluate the previous training they received.

9. **What should a district do about employees who do not attend ERK training sessions? How many times do we need to offer it, to avoid being cited for failure to train them?**

The employer is responsible for ensuring that all employees who are routinely exposed to hazardous substances, harmful physical agents or infectious agents are trained accordingly. This is the same rationale that is applied to personal protective equipment, which states that the employer shall not only provide, but ensure the use of PPE. It is not acceptable to just offer the training once or twice and see who shows up. You may need to make attendance a mandatory part of their contract if it isn't already. Failure to attend would then indicate that the employee is deficient in performing their duties and disciplinary action could be taken.

10. Are CD-ROM interactive training programs sufficient to meet the MN ERK training requirements if specific information regarding the location of MSDS's and PPE are provided as a written handout, as well as the name of the ERK Coordinator if they have additional questions or need more information?

There must be a "trainer" available to answer questions. The employee's immediate supervisor may be the logical choice in this situation, because they would be able to answer questions about specific procedures used in the building. The ERK Coordinator does not need to personally conduct each training session.

11. Does MN OSHA allow any leniency for annual refresher training? Must the training always be completed in 365 days or less?

Technically, refresher training should be completed within one year of the last training date. But, because of employee contract days and scheduling conflicts, you may need to use common sense. If your refresher training is **consistently** held during the first month of school for example, you have met the general intent of the regulation and would not be cited.

12. Can hazardous substance training be done by "category of harm" rather than on product specific hazards?

Yes. Training does not need to be provided on each specific product found in the workplace. The employer has the option of training employees on "categories of harm" associated with products that are or may be encountered by an employee (e.g. corrosives, carcinogens, flammables, etc.). This approach may be especially useful when products and vendors change frequently. OSHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. They do, however, require that employees know where to obtain additional information. Inspectors will routinely ask employees at random if they know who their Employee Right-To-Know Coordinator is, and where the MSDS's are kept. Training should include an explanation of the types of information available on MSDS's, and how to access them. Labels will serve as an immediate reminder of hazard information, while MSDS's provide employees with a detailed reference source.

13. Would the district's administrative, secretarial, and clerical staff require ERK training because of their exposure to standard office products?

No. Most office supplies would be exempt, either as nontoxic products or as consumer products. Intermittent use of a copying machine, including occasional changes of toner, would not result in coverage under the standard. However, an employee who operates a copying machine all day as their primary job function, and/or handles chemicals while servicing the equipment would need to be trained.

14. Would elementary and general education teachers in non-laboratory/shop classrooms require ERK hazardous substance training because of their exposure to white board cleaner, markers, water color paints, rubber cement and other similar products?

No. Most of these products would be exempt as non-toxic or consumer products.

15. Would elementary art teachers require ERK "hazardous substance" training for their brief exposure to the following products during classroom demonstrations; water color paints, tempera paints, Elmer's glue, rubber cement, washable markers, charcoal, crayons, clay, non-toxic glazes, etc.?

In the majority of cases, they would not have to be trained. Most of these products would be exempt as non-toxic or consumer products, as long as they are being used in the same form, concentration and manner as a consumer would normally use them. Each district would need to evaluate the specific products being used and the frequency of exposure.

16. Would junior and senior high art teachers require ERK "hazardous substance" training for their brief exposure to the following products during classroom demonstrations; oil based paints, acrylic paints, tempera paints, charcoal drawing pencils, permanent markers, inks, rubber cement, mineral spirits, clay, non-toxic glazes, and possibly soldering fumes in jewelry making?

Even though many of these products would be exempt, either as non-toxic or "consumer products", they are probably being used more often than a consumer would normally use them, or in way that is not intended by the manufacturer. Each district would need to evaluate the specific products being used and the frequency of exposure.

17. Would industrial technology teachers (e.g. wood shop, metal shop, graphic arts, motor repair, etc.) require ERK "hazardous substance" training for their brief exposure to the following products during classroom demonstrations; paint, mineral spirits, parts cleaning solvents, lubricants, grease, oil, gasoline, wood stains, varnishes, inks, photographic fixer developer, etc.?

Even though many of these products would be exempt, either as non-toxic or "consumer products", they are probably being used more often than a consumer would normally use them. Each district would need to evaluate the specific products being used, the frequency of exposure, and how the product is being used.

18. Are science teachers exempt from hazardous substance training under MN ERK because they are "technically qualified" (e.g. they have more knowledge about the products they use than the instructor)?

In 1989, the statutory definition of "technically qualified individual" (TQI) was revised so that now, the only individuals who may claim TQI status are: physicians, dentists, pharmacists, or lead research individuals. However, if they are in compliance with OSHA's Laboratory Safety Standard, 29 CFR 1910.1450, additional training under MN ERK would not be necessary. They should however, be informed of the district's labeling procedures, the location and use of MSDS's, and who to contact for more information (ERK coordinator).

19. Would students hired in the summer for mowing, weed trimming, and possibly some interior painting during wet weather need to be trained under MN ERK for hazardous substances?

The definition of "employee" includes part-time, temporary and seasonal workers. Students may or may not have experience working with these types of products. Even though the gas, oil and latex paint they are using might fall under the "consumer product" exemption described earlier, training should be considered. Because the products they will be working with are very limited, the training should only take a few minutes. Depending on the equipment being operated, you may also need to provide training on hearing conservation and the use of ear plugs, ear muffs, or other PPE.

20. Do warehouse employees need to be trained on every product they handle?

No. Because of the exemption listed in the MN ERK Standard (see question #4), employees who only handle sealed containers would not require training. However, the employer would need to provide training to any employee who is designated to respond to spills, leaks, and other emergencies involving hazardous substances.

21. Would an employee need "infectious agent" training under the MN ERK Standard if they are already receiving bloodborne pathogen training under the Federal standard?

The information required to be presented as part of the training program for infectious agents was amended in 1992 to coincide with the training required for bloodborne pathogens under 1910.1030. This change allows employers to conduct one training program that covers all infectious agents (bloodborne pathogens are infectious agents) and have that program satisfy the requirements of ERK and 1910.1030. Your Bloodborne Pathogen training program may need to be expanded, but much of the information is the same. In most cases, the employee groups being trained under each regulation will also be the same. Training should provide sufficient information on the chain of infection, universal precautions and the availability of personal protective equipment.

22. Would general education teachers need "infectious agent" training under MN ERK?

No, unless they have been assigned first aid responsibilities, or have other specific duties that require direct contact with body fluids. For example, an English teacher who sends students to the nurse when they feel ill would not require infectious agent training.

23. Would physical education instructors, physical therapists, coaches, or playground supervisors need "infectious agent" training under MN ERK?

If the employee's responsibility is solely to provide verbal direction for administering self-care of injuries and/or call for emergency assistance (i.e. the school nurse or 911), and they are not responsible for body fluid clean-up, training would not be required. If the staff has been assigned first aid or body fluid clean-up responsibilities, training is required. If you combine your bloodborne pathogen and infectious agent training, as discussed in question #21, no additional training would be needed. Exposure to perspiration alone would not require training under either standard. Staff who are exposed to body fluids through "Good Samaritan" acts would also be exempt from infectious agent training.

24. Would special education teachers need infectious agent training under MN ERK?

If the special education teachers have routine exposure to body fluids though first aid, suctioning of tracheas, diapering, spill clean-up, or other personal hygiene-related activities, they would need to be trained. This may include individuals that would not require training for bloodborne pathogens (e.g. if diapering was their only source of exposure). As discussed in question #21, a comprehensive bloodborne pathogen training that includes other infectious agents would cover both training requirements.

25. Are school nurses exempt from ERK "infectious agent" training because they are "technically qualified individuals"?

In 1989, the statutory definition of "technically qualified individual" (TQI) was revised so that now, the only individuals who may claim TQI status are: physicians, dentists, pharmacists, or lead research individuals. But, if your nurses are attending an annual "infection control" training session as part of their continuing education requirements, they would not need to attend additional **refresher** training for "infectious agents" or bloodborne pathogens. The **initial** training they receive must be comprehensive and district specific. Information regarding district specific procedures would need to be provided any time there are changes from the initial training they attended.

26. Are MSDS's located in a networked, computerized program considered accessible if training components include how to manipulate the program and access needed information?

Yes, provided that a hard copy is available to the employee requesting it within 24 hours.

27. Would it be acceptable for each building have a "master" manual of MSDS's or computerized program for all of the hazardous substances used in the district?

Yes, as long as employees understand where the information is located and how to access it. By including MSDS's for all of the products used within the district in each set of manuals, you can avoid complications that arise when individual products in various departments are exchanged. It is much easier to update, track, and maintain a system that is consistent in each facility. MSDS's for new products can be added to all of the manuals simultaneously, instead of school by school, or department by department as needed.

28. Are MSDS's required for items that fall under the "consumer product" exemption?

No, not if the products are used in the same form, concentration and manner as a consumer would normally use them. If they are not being used in the same manner, an MSDS would be required. Even during "normal consumer use" many consumer products can still be hazardous. If they are frequently used, you may want to consider adding the MSDS to your file anyway. Products that employees bring to work for their own personal use are exempt.

29. What information is required on a secondary container label?

At a minimum, the secondary container label must contain the identity of the hazardous substance, and the appropriate hazard warnings. It is also recommended to have the product name and manufacturer's name listed so that employees can easily refer to the MSDS if needed. Since employees should have already been trained on the personal protective equipment (PPE) required for each type of hazard under the PPE Standard, the protective equipment needed for each product would not have to be listed on the label. Labeling each container might be beneficial however, since products are used in different ways that may require varying degrees of protection. You may also want to include information on the route of entry (inhalation, ingestion or absorption) and specific target organs.

Appendix A

ERK Exposure Assessment Guide

WAYZATA PUBLIC SCHOOLS
EMPLOYEE TITLE CLASSIFICATIONS

JOB TITLE	EXPOSURE UNLIKELY	HAZARDOUS SUBSTANCES	INFECTIOUS AGENTS	PHYSICAL AGENTS
Superintendent	✓			
Superintendent, Executive Assistant	✓			
Superintendent, Secretary	✓			
Human Resource Services, Director	✓			
Human Resource Services, Secretary	✓			
Benefits/Substitutes, Coordinator	✓			
Receptionist, District	✓			
Human Resource Services, Para	✓			
Curriculum & Instruction, Director	✓			
Curriculum & Instruction, Secretary	✓			
Finance & Business, Director	✓			
Finance & Business, Secretary	✓			
Controller	✓			
Accountant	✓			
Bookkeeper	✓			
Accounts Payable, Secretary	✓			
Accounting, Secretary	✓			
Special Education, Director	✓			
Special Services, Supervisor	✓			
Early Childhood Coordinator	✓			
Special Education, Secretary	✓			
Purchasing/Data Processing, Coordinator	✓			
Purchasing, Secretary	✓			
Student Census, Clerk	✓			
Payroll Manager	✗			
Payroll Technician	✗			
Buildings & Grounds, Supervisor		✓		✓
Buildings & Grounds, Secretary	✓			
Health & Safety Specialist		✓	✓	✓
Food Service, Supervisor	✓			
Food Service, Secretary	✓			
Grounds Foreman		✓		✓
Grounds Crew		✓		✓
Carpenter		✓		✓
Mechanic		✓		✓
Painter		✓		✓
Plumbing/Heating		✓	✓	✓
Truck Drivers	✓			
Warehouse Clerk	✓			
Technology, Director	✓			
Technology, Secretary	✓			
Technology, Para	✓			
Computer Coordinator	✓			
Network Specialist	✓			
Video Technician	✓			

WAYZATA PUBLIC SCHOOLS
EMPLOYEE TITLE CLASSIFICATIONS

Counselor Secretary, Secondary	✓			
Chemical Health Coordinator, Secondary	✓			
Music Teacher, Secondary	✓			
Communications Teacher, Secondary	✓			
PE/Health Teacher, Secondary	✓			
Focus Teacher, Secondary	✓			
Family & Consumer Science Teacher - Sec.	✓			
Industrial Technology - Secondary		✓		✓
Science Teacher - Secondary		✓		
World Language Teacher - Secondary	✓			
Social Studies Teacher - Secondary	✓			
Business Education Teacher - Secondary	✓			
Math Teacher - Secondary	✓			
Art Teacher - Secondary		✓		
Secretarial Pool - Sr. High	✓			
Paras - Sr. High	✓			
Health Para, Secondary			✓	
Xerox Para - Sr. High	✓			
Hall Monitors - Sr. High	✓			
Media/Library Specialist, Secondary	✓			
Media/Technology Specialist - Sr. High	✓			
Assessment & Evaluation Coordinator	✓			
Assessment & Evaluation, Secretary	✓			
Transportation Coordinator	✓			
Transportation, Secretary	✓			
Special Education Teachers, Secondary			✓	
Special Education Paras - Secondary			✓	
MSMH Teacher - Secondary			✓	
MSMH Para - Secondary			✓	
TAP Teachers - Sr. High	✓			
TAP Para - Sr. High	✓			
Food Service Staff - Secondary		✓		
Youth Service Advisor - Sr. High	✓			
Police Liaison Officer - Sr. High	✓			
AV/Computer Technician - Sr. High	✓			
Teacher, Elementary	✓			
Secretary, Elementary	✓			
Media Specialist, Elementary	✓			
Art Teacher, Elementary	✓			
Music Teacher, Elementary	✓			
Physical Education Teacher, Elementary			✓	
Adaptive Phy Ed, Elementary			✓	
Health Para, Elementary	✓			
Computer Para, Elementary	✓			
Teacher Para, Elementary	✓			
Special Services Para, Elementary	✓			
Psychologist, Elementary	✓			

WAYZATA PUBLIC SCHOOLS
EMPLOYEE TITLE CLASSIFICATIONS

Electronics Technician	✓	
SASI Aministrative Technician	✓	
SASI Student Technician	✓	
Reading Office, Secretary	✓	
Elementary Science Center, Consultant	✓	
Elementary Science Center, Para	✓	
Vision 21, Director	✓	
Vision 21, Coordinators	✓	
Vision 21, Paras	✓	
Psychologist	✓	
Social Worker	✓	
Occupational Therapist	✓	
Adapted PE		✓
ECSE Teachers		✓
School Nurse		✓
Preschool Screening Nurse	✓	
Speech Clinician	✓	
ESL Teacher	✓	
Community Education, Director	✓	
Community Education, Secretary	✓	
Home Base/WISHES Coordinator	✓	
WISHES Facilitator	✓	
Home Base, Counselor	✓	
Community Education, Attendant ARENA	✓	
Volunteer Coordinator	✓	
Community Education, Para	✓	
Adult Enrichment Coordinator	✓	
Aquatics Supervisor		✓
Adult Basic Education Coordinator	✓	
Facilities/Youth Service Coordinator	✓	
Youth Services Advisor	✓	
Community & Collaboration Coordinator	✓	
ECFE Coordinator	✓	
ECFE, Clerical Para	✓	
ECFE, Teacher		✓
ECFE Program Development Specialist		✓
ECFE, Teacher Para		✓
Learning Readiness Manager	✓	
Principal, Secondary	✓	
Assistant Principal, Secondary	✓	
Principal Secretary, Secondary	✓	
Attendance Secretary, Secondary	✓	
Administrative Assistant, Sr. High	✓	
Activities Director, Sr. High	✓	
Assistant Activities Director - Sr. High	✓	
Activities Secretary - Sr. High	✓	
Counselor, Secondary	✓	

WAYZATA PUBLIC SCHOOLS
EMPLOYEE TITLE CLASSIFICATIONS

Social Worker, Elementary	✓			
Special Education Teacher, Elementary			✓	
Speech Teacher, Elementary	✓			
Home Base Staff, Elementary			✓	
Food Service, Elementary		✓		
Custodian, ~~Elementary~~		✓	✓	✓
Principal, Elementary	✓			
Volunteer Facilitator, Elementary	✓			
Community Ed. Bldg Supervisor		✓	✓	

Appendix B

Hearing Conservation
Reference Information

This section will review, in a summary fashion, the key elements of OSHA's Occupational Noise Exposure Standard, and the subsequent Hearing Conservation Amendment. Copies of the specific regulations are located in appendix A of this manual. It is suggested that these materials be read in addition to this summary.

The Occupational Noise Exposure Standard.

The first direct occupational noise standard of a national scope was derived from Walsh-Healey Public Contracts Act. In 1971 it was adopted under the Occupational Safety and Health act. This regulation is a rather simple and direct one page document which defines noise as a hearing health risk and gives direction on what needs to be done if noise is detected.

Noise is determined to be any sound with a continuous level of 90dBA which persists for 8 hours. In addition, those variable sounds which result in an equivalent level of 90dBA are also of concern. In either circumstance, these conditions result in a maximum Permissible Exposure Level (PEL) of 90 dBA resulting in an exposure of 100%. Noises with a higher level than 90dBA can be sustained for periods of less than 8 hours depending on their magnitude, and sounds with average levels less than 90dBA can persist for periods of more than 8 hours. Changes in the level above and below 90dBA, and in the work day period of 8 hours will alter the percentage of actual exposure. Table G-16 in fig II-1 defines the effect of level increase or decrease, and the relationship of time to total exposure. Measurements to determine the worker's exposure are to be made utilizing a threshold of 90dB, thus the measurement starting point and maximum allowable are the same level

If noise is determined to be present, employers are required to make either engineering or administrative efforts to control the noise. If these efforts are not successful, personal protective equipment must be provided. In addition, while personal protective equipment is in use, an "effective hearing conservation program shall be administered".

Fig II-1. Table G-16 - Permissible Noise Exposure[1].

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

[1]When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fraction: $C_1/T_1+C_2/T_2+C_n/T_n$ exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C_n indicates the total time of exposure at a specified noise level, and T_n indicates the total time of exposure permitted at this level. Exposure to impulsive or impact noise should not exceed 140dB peak sound pressure level.

AVERAGE OVER TIME

OSHA regulations require that an individual's time weighted daily noise exposure must not exceed 90 dBA over a period of 8 hours. This exposure level is equal to a 100% dose. If the average is above 90 dB, the dose is higher than 100% and if the average level is below 90 dB, dose is less than 100%.

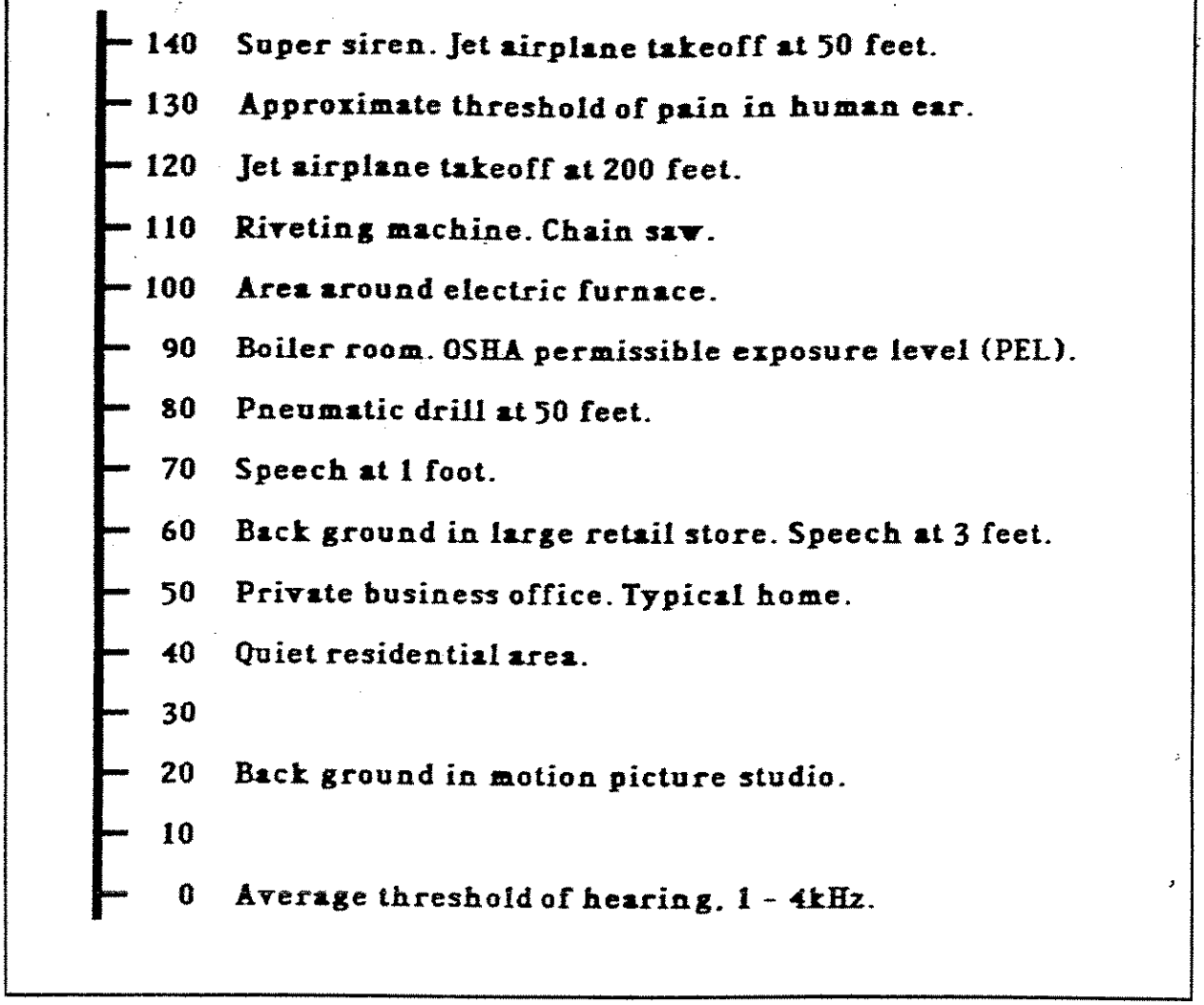
Earlier we learned that 90 dB + 90 dB = 93 dB. This calculation was based on an equal energy principal or 3 dB exchange rate. Exchange rate is the decibel level that equals a doubling of energy (Also called doubling rate). OSHA uses a 5 dB exchange rate. This means that if the average increases 5 dB the dose doubles, and if it decreases 5 dB the dose is halved. So if 90 dB equals 100% dose, then 95 dB equals 200% dose, 85 dB equals 50% dose, etc. The exchange rate of 5 dB that OSHA uses is a variation from acoustic standards, but is designed to achieve accurate hearing loss potential. So for our purpose in this manual the exchange rate of 5 dB will be used from now on.

When sound levels are averaged over a period of time the result is called L-Avg (Level Average). If the sound level is averaged over exactly 8 hours the result is called TWA (Time Weighted Average). If a worker is being monitored for 4 hours and the average level (L-Avg) is found to be 90 dB, the TWA will be less than 90 dB since the same noise exposure is averaged over greater period of time (8 hours). The TWA in this example will be 85 dB since the time is half and the doubling/halving rate is 5 dB. So 90 dB over 4 hours is the same exposure as 85 dB over 8 hours. If we continued to monitor the same worker for another 4 hours at the same noise level, the L-Avg would stay the same as the the period of time it will be averaged over will simply increase with the sampling time. The TWA which is always over 8 hours, however, will now increase to 90 dB and the dose will be 100%. If on the other hand we continued to sample for 4 hours with no noise present the TWA and dose would remain unchanged, but the L-Avg would decrease as the real average obviously is less. It is now apparent that the TWA and the dose only can increase or stay steady, where the L-Avg can vary up or down as time elapses. Here are some more examples:

90dB	continuous for	8 hours	equal	90 dB TWA	or	100% dose
95dB	continuous for	8 hours	equal	95 dB TWA	or	200% dose
90dB	continuous for	16 hours	equal	95 dB TWA	or	200% dose
90dB	continuous for	4 hours	equal	85 dB TWA	or	50% dose
95dB	continuous for	4 hours	equal	90 dB TWA	or	100% dose
80dB	continuous for	16 hours	equal	85 dB TWA	or	50% dose
110dB	continuous for	2 hours	equal	100 dB TWA	or	400% dose

Fig I-18 shows a 5 minute noise sample with typical noise variations. The L-Avg will stabilize over time, but the dose will keep increasing at a rate determined by the noise level.

Typical sound levels, measured "A"/slow.



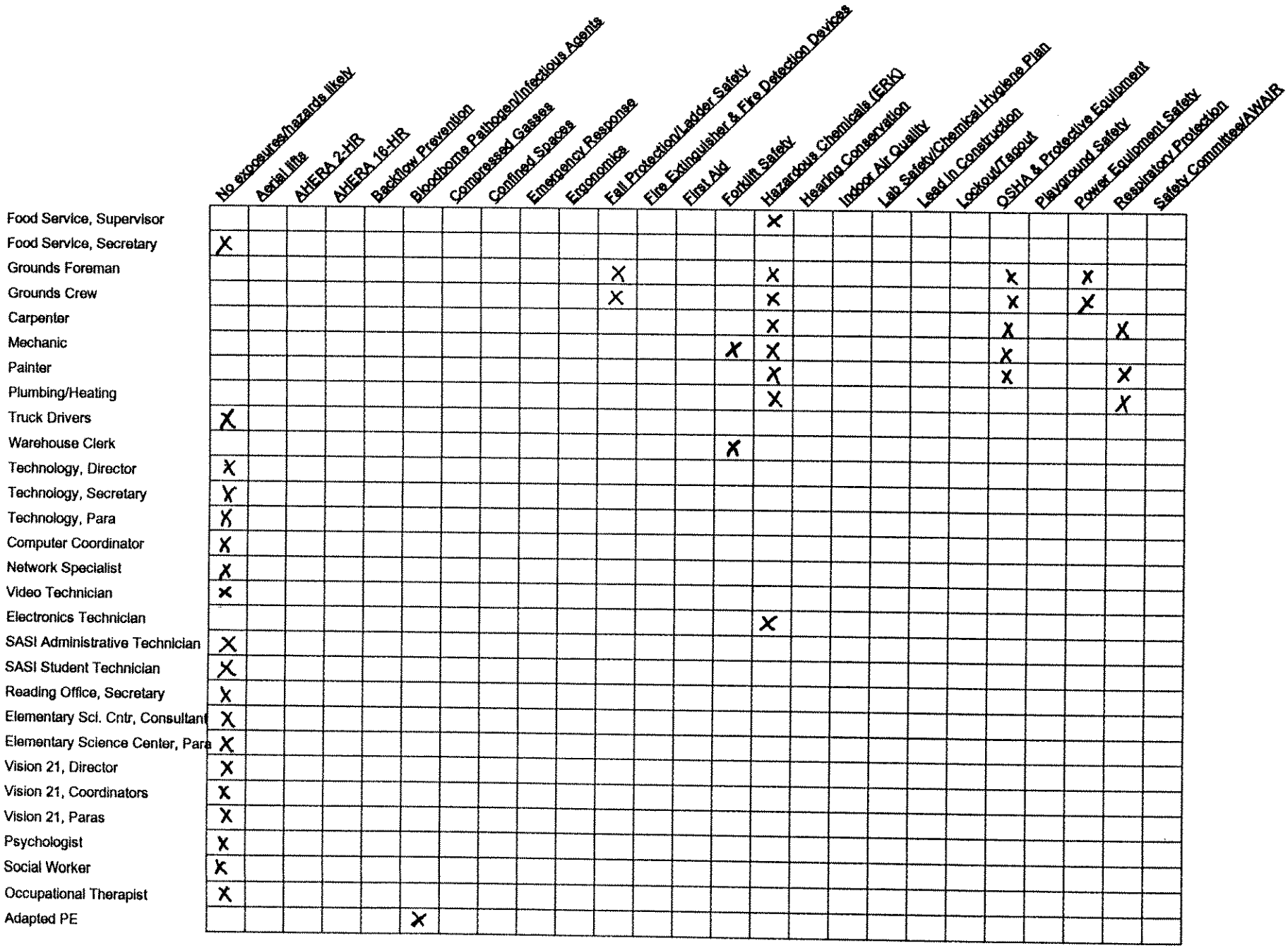
Appendix C

Example of
Health & Safety Training Curriculum

ISD 284 EMPLOYEE HEALTH & SAFETY TRAINING CURRICULUM

	No exposures/hazards likely	Aerial lifts	AHERA 2-HR	AHERA 16-HR	Backflow Prevention	Bloodborne Pathogen/Infectious Agents	Compressed Gasses	Confined Spaces	Emergency Response	Ergonomics	Fall Protection/Ladder Safety	Fire Extinguisher & Fire Detection Devices	First Aid	Forklift Safety	Hazardous Chemicals (ERK)	Hearing Conservation	Indoor Air Quality	Lab Safety/Chemical Hygiene Plan	Lead in Construction	Lockout/Tagout	Personal Protective Equipment	Playground Safety	Power Equipment Safety	Respiratory Protection	Safety Committee/AWAIR
Superintendent	X																								
Superintendent, Exec. Assistant	X																								
Superintendent, Secretary	X																								
Human Resource, Director	X																								
Human Resource Secretary	X																								
Benefits/Substitutes, Coordinator	X																								
Receptionist, District	X																								
Human Resource Services, Para	X																								
Curriculum & Instruction, Director	X																								
Curriculum & Instruction, Secretary	X																								
Finance & Business, Director	X																								
Finance and Business, Secretary	X																								
Controller	X																								
Accountant	X																								
Bookkeeper	X																								
Accounts Payable, Secretary	X																								
Accounting, Secretary	X																								
Special Education, Director						X																			
Special Services, Supervisor	X																								
Special Education, Secretary	X																								
Early Childhood Coordinator						X																			
Purchasing/Data Process., Coord	X																								
Purchasing, Secretary	X																								
Student Census, Clerk	X																								
Payroll Manager	X																								
Payroll Technician	X																								
Buildings & Grounds, Supervisor		X					X				X	X			X	X						X	X	X	X	
Buildings & Ground, Secretary	X																								
Health & Safety Specialist		X		X	X	X	X	X			X	X			X	X	X			X	X	X	X	X	X

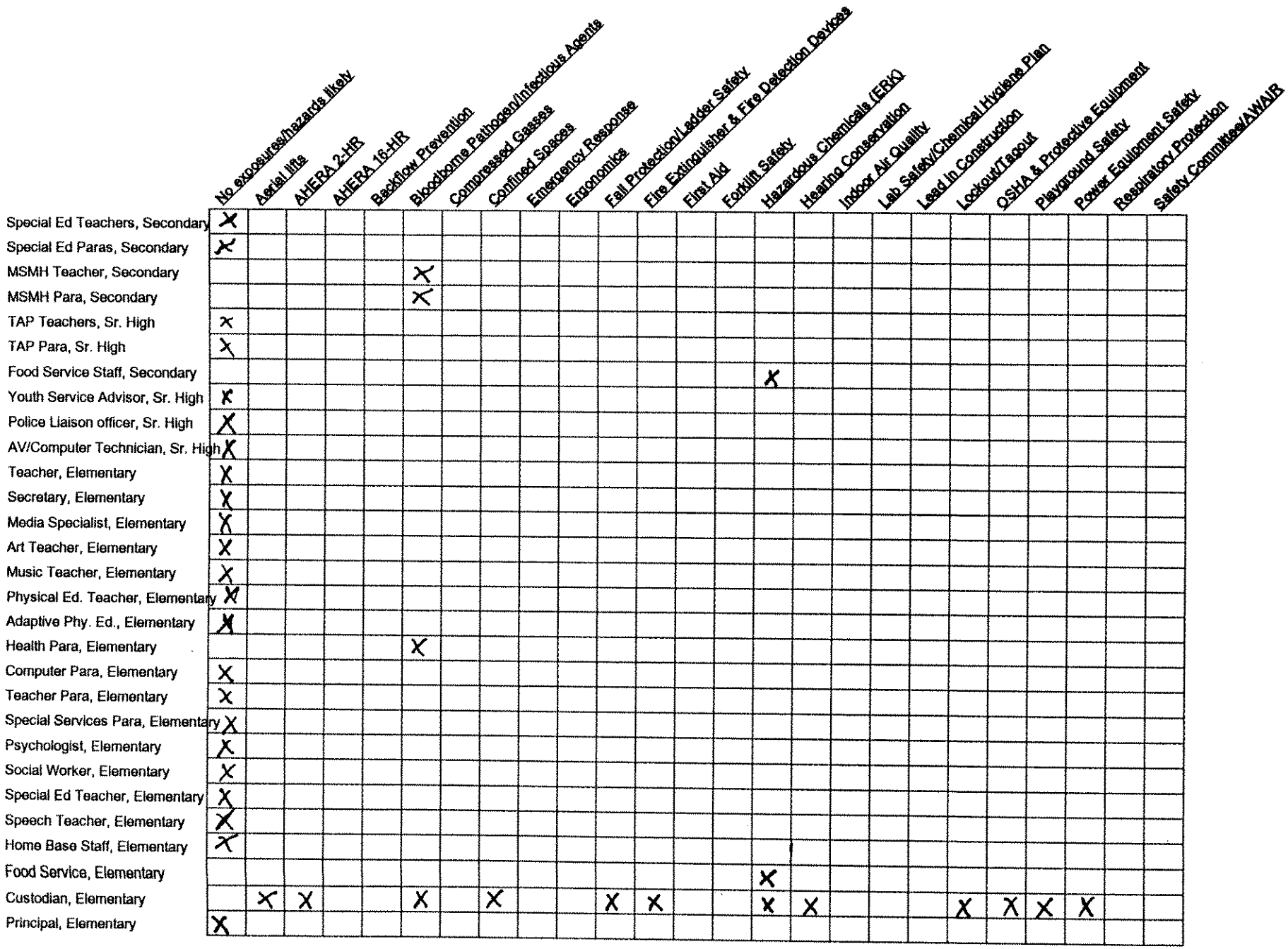
NOTE: "X" DESIGNATES TRAINING PROGRAMS THAT MUST BE COMPLETED BY WAYZATA ISD 284 EMPLOYEES PRIOR TO PERFORMING ASSIGNED DUTIES.

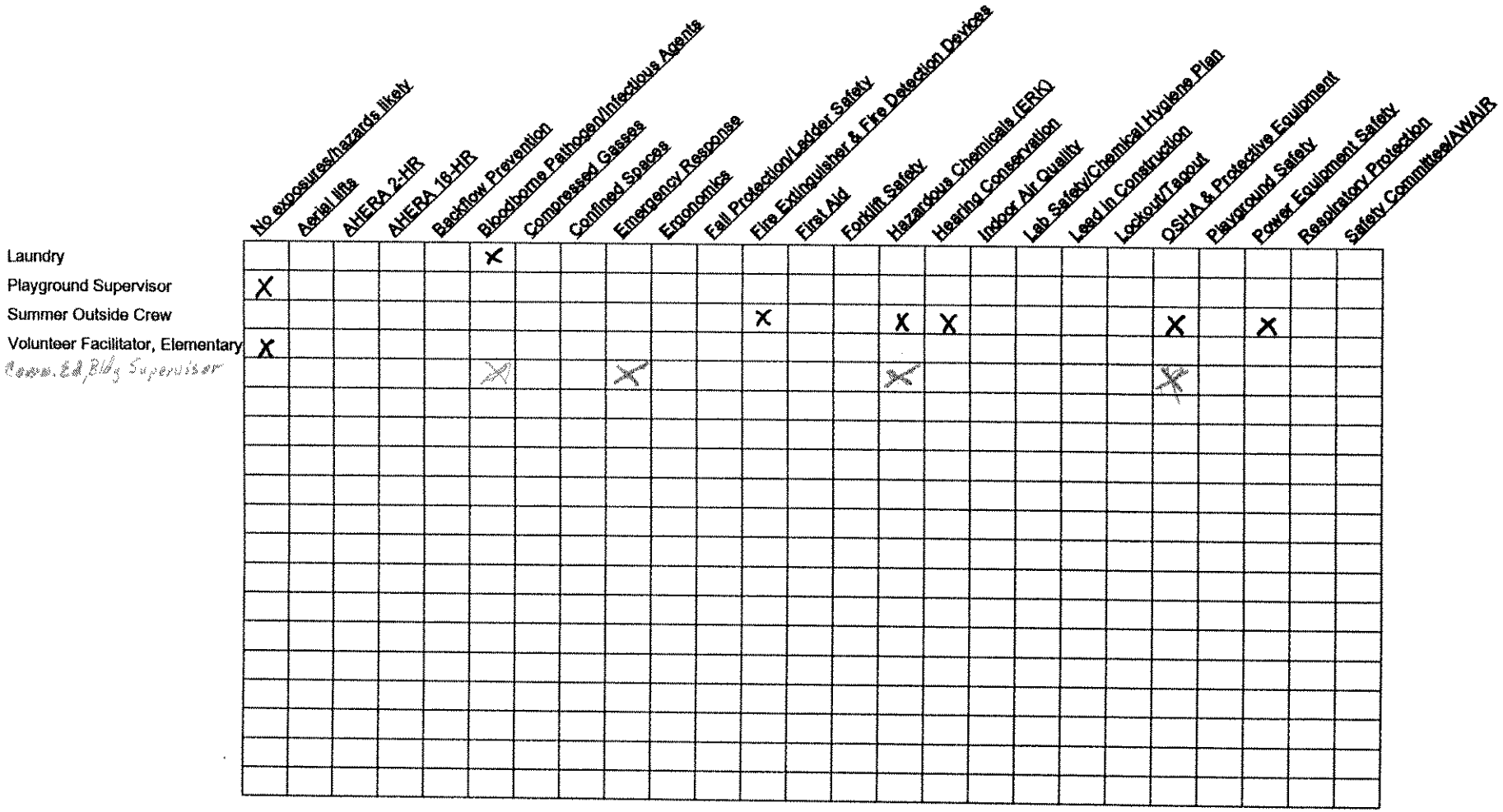

No exposures/hazards likely
Aerial lifts
AHERA 2-HR
AHERA 16-HR
Backflow Prevention
Bloodborne Pathogen/Infectious Agents
Compressed Gasses
Confined Spaces
Emergency Response
Ergonomics
Fall Protection/Ladder Safety
Fire Extinguisher & Fire Detection Devices
First Aid
Forklift Safety
Hazardous Chemicals (ERK)
Hearing Conservation
Indoor Air Quality
Lab Safety/Chemical Hygiene Plan
Lead in Construction
Lockout/Tagout
OSHA & Protective Equipment
Playground Safety
Power Equipment Safety
Respiratory Protection
Safety Committees/AWAIR
Food Service, Supervisor
Food Service, Secretary
Grounds Foreman
Grounds Crew
Carpenter
Mechanic
Painter
Plumbing/Heating
Truck Drivers
Warehouse Clerk
Technology, Director
Technology, Secretary
Technology, Para
Computer Coordinator
Network Specialist
Video Technician
Electronics Technician
SASI Administrative Technician
SASI Student Technician
Reading Office, Secretary
Elementary Sci. Cntr, Consultant
Elementary Science Center, Para
Vision 21, Director
Vision 21, Coordinators
Vision 21, Paras
Psychologist
Social Worker
Occupational Therapist
Adapted PE

Reclassify!

	No exposures/hazards likely	Aerial lifts	AHERA 2-HR	AHERA 16-HR	Backflow Prevention	Bloodborne Pathogen/Infectious Agents	Compressed Gasses	Confined Spaces	Emergency Response	Ergonomics	Fall Protection/Ladder Safety	Fire Extinguisher & Fire Detection Devices	First Aid	Forklift Safety	Hazardous Chemicals (ERK)	Hearing Conservation	Indoor Air Quality	Lab Safety/Chemical Hygiene Plan	Lead in Construction	Lockout/Tagout	OSHA & Protective Equipment	Playground Safety	Power Equipment Safety	Respiratory Protection	Safety Committee/AWAIR
ECSE Teachers						X																			
School Nurse						X							X												
Preschool Screening Nurse	X																								
Speech Clinician	X	→				X																			
ESL Teacher	X																								
Community Education, Director	X																								
Community Education, Secretary	X																								
Home Base/WISHES Coordinator	X																								
WISHES Facilitator	X																								
Home Base, Counselor	X																								
Community Education, Attendant	X					X			X						X					X					
Volunteer Coordinator	X																								
Community Education, Para	X																								
Adult Enrichment Coordinator	X																								
Aquatics Supervisor						X							X												
Adult Basic Ed Coordinator	X																								
Facilities/Youth Service, Coord	X																								
ECFE Coordinator	X																								
ECFE, Clerical Para	X																								
ECFE, Teacher						X																			
ECFE Program Dvlpmnt Special						X																			
ECFE, Teacher Para						X																			
Learning Readiness Manager	X																								
Principal, Secondary	X																								
Assistant Principal, Secondary	X																								
Principal Secretary, Secondary	X																								
Attendance Secretary, Secondary	X																								

	No exposures/hazards likely	Aerial lifts	AHERA 2-HR	AHERA 16-HR	Backflow Prevention	Bloodborne Pathogen/Infectious Agents	Compressed Gasses	Confined Spaces	Emergency Response	Ergonomics	Fall Protection/Ladder Safety	Fire Extinguisher & Fire Detection Devices	First Aid	Forklift Safety	Hazardous Chemicals (ERK)	Hearing Conservation	Indoor Air Quality	Lab Safety/Chemical Hygiene Plan	Lead in Construction	Lockout/Tagout	OSHA & Protective Equipment	Playground Safety	Power Equipment Safety	Respiratory Protection	Safety Committee/AWAIR
Administrative Assistant, Sr. High	X																								
Activities Director, Sr. High	X																								
Assistant Activities Dir, Sr. High	X																								
Activities Secretary, Sr. High	X																								
Counselor, Secondary	X																								
Counselor Secretary, Secondary	X																								
Chemical Hlth Coord, Secondary	X																								
Music Teacher, Secondary	X																								
Communications Teach, Sec.	X																								
PE/Health Teacher, Secondary	X																								
Focus Teacher, Secondary	X																								
Family & Consumer Sci Teacher, Sec.	X																								
Industrial Technology, Secondary														X											
Science Teacher, Secondary																	X								
World Language, Secondary	X																								
Soc. Studies Teacher, Secondary	X																								
Bus. Ed. Teacher, Secondary	X																								
Math Teacher, Secondary	X																								
Secretarial Pool, Sr. High	X																								
Paras, Sr. High	X																								
Health Para, Secondary						X																			
Xerox Para, Sr. High	X																								
Hall Monitors, Sr. High	X																								
Media/Library Spec, Secondary	X																								
Media/Technology Spec, Sr. High	X																								
Assessment & Evaluation, Coord	X																								
Assessment & Evaluation, Sec.	X																								
Transportation Coordinator	X																								
Transportation, Secretary	X																								


No exposures/hazards likely
Aerial lifts
AHERA 2-HR
AHERA 16-HR
Backflow Prevention
Bloodborne Pathogen/Infectious Agents
Compressed Gasses
Confined Spaces
Emergency Response
Ergonomics
Fall Protection/Ladder Safety
Fire Extinguisher & Fire Detection Devices
First Aid
Forklift Safety
Hazardous Chemicals (ERK)
Hearing Conservation
Indoor Air Quality
Lab Safety/Chemical Hygiene Plan
Lead in Construction
Lockout/Tagout
OSHA & Protective Equipment
Playground Safety
Power Equipment Safety
Respiratory Protection
Safety Committee/AWAIR
Special Ed Teachers, Secondary
Special Ed Paras, Secondary
MSMH Teacher, Secondary
MSMH Para, Secondary
TAP Teachers, Sr. High
TAP Para, Sr. High
Food Service Staff, Secondary
Youth Service Advisor, Sr. High
Police Liaison officer, Sr. High
AV/Computer Technician, Sr. High
Teacher, Elementary
Secretary, Elementary
Media Specialist, Elementary
Art Teacher, Elementary
Music Teacher, Elementary
Physical Ed. Teacher, Elementary
Adaptive Phy. Ed., Elementary
Health Para, Elementary
Computer Para, Elementary
Teacher Para, Elementary
Special Services Para, Elementary
Psychologist, Elementary
Social Worker, Elementary
Special Ed Teacher, Elementary
Speech Teacher, Elementary
Home Base Staff, Elementary
Food Service, Elementary
Custodian, Elementary
Principal, Elementary


No exposures/hazards likely
Aerial lifts
AHERA 2-HR
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Bloodborne Pathogen/Infectious Agents
Compressed Gasses
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First Aid
Forklift Safety
Hazardous Chemicals (ERK)
Hearing Conservation
Indoor Air Quality
Lab Safety/Chemical Hygiene Plan
Lead in Construction
Lockout/Tagout
OSHA & Protective Equipment
Playground Safety
Power Equipment Safety
Respiratory Protection
Safety Committee/AWAIR
Laundry
Playground Supervisor
Summer Outside Crew
Volunteer Facilitator, Elementary
Rowe, Ed/Bldg Supervisor

Appendix D

MN OSHA
ERK Enforcement Guidelines

SUBJECT: Enforcement Guidelines for the Employee Right-to-Know Standard (Minnesota Rules Chapter 5206) in General Industry and Construction.

Purpose: This instruction establishes policies and provides clarifications to ensure uniform inspection procedures are followed when conducting inspections to enforce the Employee Right-to-Know Standard.

Scope: This instruction applies Minnesota OSHA-wide.

References:

1. MNOSHA Field Compliance Manual (FCM) and Compliance Rating Guide (CRG).
2. Minnesota Rules, Chapter 5206, "Employee Right-to-Know Standard" - 5205.0100 to 5205.1200."
3. Minnesota Rules 5210.0900 to 5210.0960, "Trade Secret Registration."
4. Minnesota Rule 5205.0110, "Workroom Ventilation and Temperature."
5. 29 CFR 1910.20, "Access to Employee Exposure and Medical Records."
6. 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories."
7. 29 CFR 1910.95 and 1926.52, "Occupational Noise Exposure."
8. 29 CFR 1910.96 and 1926.53, "Ionizing Radiation."
9. 29 CFR 1910.97 and 1926.54, "Nonionizing Radiation."
10. 29 CFR 1910.1200, "Hazard Communication."
11. MNOSHA Instruction CPL 2.111, "Paperwork and Written Program Violations."
12. Federal OSHA Instruction CPL 2-2.38C, "Inspection Procedures for the Hazard Communication Standard."
13. Federal OSHA Instruction CPL 2.111, "Citation Policy for Paperwork and Written Program Requirement Violations," - Appendix A, "Documentation of Citations Related to the Exposure to Hazardous Substances and Consumer Products."

Cancellation: This instruction cancels the following directives:

1. MNOSHA Instruction STD 5-2.1, "Material Safety Data Sheets for Drugs Under the Employee Right-to-Know Standard,"
2. MNOSHA Instruction CPL 2-2.38A, "Enforcement of Employee Right-to-Know at Construction Sites."

Provided by the:
WORKPLACE SAFETY CONSULTATION DIVISION
Department of Labor and Industry
443 Lafayette Road
St. Paul, Minnesota 55155-4311
(612) 297-2393
Safety and Health Assistance for Minnesota Employers

3. MNOSHA Instruction CPL 2-2.38B, "Severity/ Probability Rating Guidelines for Right-to-Know Citations."

4. MNOSHA Instruction CPL 2-2.39, "Material Safety Data Sheets."

5. MNOSHA Instruction CPL 2-2.38C, "Enforcement Guidelines for the Employee Right-to-Know Standard (Minnesota Rules Chapter 5206) in General Industry and Construction, dated September 24, 1993.

Background:

The Employee Right-to-Know Act was passed by the Minnesota Legislature in 1983 and has been revised several times since then. At the time of its adoption, it was a new concept for employers and MNOSHA's enforcement of the Act was directed at the establishment of rudimentary Employee Right-to-Know (ERTK) programs. Since then, Federal OSHA has issued its Hazard Communication Standard and employers have a wider knowledge of the requirements for such programs. Minnesota OSHA has not adopted the federal Hazard Communication Standard but continues to enforce the Employee Right-to-Know Standard.

The Employee Right-to-Know Act applies to all employers in Minnesota with the exception of Federal agencies. It does not differentiate between general industry and construction.

The Act is intended to ensure that employees are aware of the dangers associated with hazardous substances, harmful physical agents, or infectious agents they may be exposed to in their workplaces. Employers are required to evaluate, or survey, their workplaces for the presence of hazardous substances, harmful physical agents, and infectious agents and provide training to employees concerning those substances or agents. A written ERTK program is required.

In December, 1992, the Employee Right-to-Know Standard was updated to incorporate all changes made in the Act by the Legislature since 1989. Changes included a new definition for Technically Qualified Individuals, removal of the exclusive application of infectious agents provisions to hospitals and clinics and extending coverage to all employers, and amendments to coincide with the adoption of the new Occupational Exposure to Bloodborne Pathogens Standard.

This instruction includes clarifications and interpretations which respond to the most frequently asked questions and points of common misunderstanding.

Action:

GENERAL.

A. Inspections. All inspections shall include, if appropriate, a review of the employer's ERTK program and employee interviews to assess compliance with the standard.

1. Every employer who has employees who are "routinely exposed" to hazardous substances, harmful physical agents, or infectious agents must comply with the requirements of the ERTK standard.

2. "Routinely exposed" means that a reasonable potential exists for exposure to hazardous substances, harmful physical agents, or infectious agents during the normal course of the employees' work assignments. It includes working in areas where hazardous substances have been spilled and assignment to cleaning up leaks and spills. It does not include a simple walk-through of an area where a substance or agent is present and no significant exposure occurs.

B. Temporary Employees. If temporary, seasonal, or part-time workers are exposed to hazardous substances, harmful physical agents, or infectious agents by the tasks they are assigned to perform, they must also be covered under the ERTK program.

C. Citation Guidelines. The ERTK standard incorporates both specification and performance requirements which are result-oriented, providing goals for achievement and allowing employers the flexibility to develop a program suitable for their particular worksite. In evaluating compliance with the standard, OSHIs should always consider whether the intent of the provisions has been met.

MULTI-EMPLOYER WORKSITES:

A. Definition. The term "multi-employer worksite" means those establishments where employees of more than one employer are performing work and are exposed to hazardous substances, harmful physical agents, and/or infectious agents. All types of worksites may be multi-employer worksites, not just construction sites.

B. Information Exchange. The MSDS information exchange or access requirements of ERTK pertain to employers who introduce hazardous substances into the worksite and expose another employer's employees. This requirement covers each hazardous substance to which the other employer's employees may be exposed.

The controlling employer or general contractor on a multi-employer worksite is required to provide other employers or contractors with a copy of pertinent MSDSs or to make them available at a central location in the facility. Therefore, one employer does not actually have to physically give another employer the MSDSs, but must inform the other employer of the location where the MSDSs will be maintained.

C. Site Responsibility. The controlling employer or general contractor has overall site safety responsibility. Subcontractors have responsibilities to their own employees and to each other. More than one employer or contractor may be cited for ERTK violations if the condition affects more than one employer's employees (e.g., carbon monoxide exposure or the use of silica sand in abrasive blasting, etc.).

D. Citation Guidelines. In accordance with Field Compliance Manual (FCM) Chapter V, citations shall be issued to each employer whose employees are exposed to violations of the ERTK standard. The controlling employer or contractor who has created the hazard will be cited regardless of who employs the exposed employees. Employers who knowingly, or due to inadequate diligence, expose their

employees to hazards not created by themselves will also be cited. The controlling employer or general contractor may be cited if one contractor exposes another contractor's employees to hazards even though the general or controlling employer's own employees are not exposed. To determine whether or not to cite an employer who did not create the hazard, the OSHI must determine whether the employer was reasonably diligent in surveying the worksite for hazards covered by ERTK. All exposed workers will be used as the number of employees for purposes of calculating penalties for these citations.

CLASSIFICATION OF VIOLATIONS:

Citations for violation of the ERTK Standard shall be assigned severity and probability ratings according to FCM Chapter VI and the MNOSHA Citation Rating Guide.

EXCEPTIONS:

A. Technically qualified individuals (TQI). TQIs are individuals who, because of their training, education, and experience, are deemed to be knowledgeable in the hazards associated with hazardous substances, harmful physical agents, and infectious agents.

Criteria that defined who qualified as a TQI were included in the original ERTK standard. However, in 1989 the Minnesota Legislature revised the statutory definition of TQI so that now the only individuals who may claim TQI status are: "physicians, dentists, pharmacists, or lead research individuals." (Definitions for these terms are included in the revised ERTK standard.)

TQIs do not need ERTK training; however, they must be notified when such training is going to be given to other employees and allowed to attend if they wish.

NOTE: The TQI exemption applies only to ERTK training and has no affect on bloodborne pathogens training that is required by 1910.1030(g)(2). Therefore, employers whose employees are exposed to bloodborne pathogens (which are infectious agents) must include TQIs in the bloodborne pathogens training. If bloodborne pathogens are covered as part of the infectious agents training program, TQIs must attend.

B. Farms. Farming operations that employ ten or fewer employees are exempt from all provisions of ERTK with the exception that label information must be provided to employees or their representatives. Farming operations employing more than ten employees or operating a temporary labor camp and employing any of its residents, must comply with the Farming Operations Training Plan Standard, Minnesota Rules 5206.1300 to 5206.1900.

C. Waste Service Employers. Employers who collect, process, or dispose of waste regulated under the federal Resource Conservation and Recovery Act are exempt from the hazardous substances and harmful physical agents training and information requirements of ERTK. Waste service employers include garbage and rubbish collectors, landfill operators, hazardous waste transporters, and independent testing laboratories or government agencies who visit hazardous waste sites.

To qualify for exemption under ERTK, waste service employers must develop and implement a training program for employees and submit that program to MNOSHA for approval. All employers known to be in this classification at the time the ERTK standard was adopted were notified of this requirement.

They were advised that their safety and health programs should include, as applicable, training in machinery hazards, proper lifting techniques, potential for exposure to hazardous materials (e.g., solvents, corrosives, acids, flammables, pressurized containers, etc.), how to handle unlabeled containers, emergency procedures, appropriate personal protective equipment, traffic hazards, operation of heavy equipment, etc. The training plans that were submitted and approved are on file in the St. Paul Office.

NOTE: The exemption from ERTK requirements for waste service employers does not extend to bloodborne pathogens. Waste service employers must provide bloodborne pathogens training as required by 1910.1030(g)(2) if employees have the potential for exposure to bloodborne pathogens as a result of their job responsibilities.

D. Laboratories. With the adoption of the Occupational Exposure to Hazardous Chemicals in Laboratories (1910.1450), confusion arose about which standard these employers must comply with-- 1910.1450 or Employee Right-to-Know. To clarify this, the 1992 update to the ERTK standard included an exemption for laboratories that meet the definition for "laboratory use of hazardous chemicals" (5206.0100, subpart 11a). These laboratories must develop and implement the Chemical Hygiene Plan required by 1910.1450 and are not required to comply with ERTK. Most quality control laboratories would not be considered "laboratories" under this definition and, since they are usually adjuncts of production operations, must comply with ERTK. In addition, establishments such as dental, photofinishing, and optical laboratories are not considered to be "laboratory" operations since they are engaged in the production of a finished product; these facilities must also comply with the requirements of ERTK.

E. Mines. Mines are not exempt under ERTK. MNOSHA will follow the procedures outlined in the MSHA/OSHA jurisdictional agreement (which provides for OSHA enforcement where no MSHA standards exist) and Federal OSHA Instruction CPL 2.42, "Interagency Agreement Between the Mine Safety and Health Administration and Occupational Safety and Health Administration," if a question arises concerning MNOSHA's ERTK enforcement in mines.

WRITTEN EMPLOYEE RIGHT-TO-KNOW (ERTK) PROGRAM:

A. OSHIs shall review the employer's written ERTK program to determine if all applicable requirements of 5206.0700, subpart 1, Items B and C, have been addressed.

B. Employers must develop and implement a written ERTK program for hazardous substances, harmful physical agents, and infectious agents which includes:

1. an outline of training that will be provided to employees;

2. a list of the hazardous substances known to be present using an identity that is referenced on the appropriate MSDS-- (the list may be compiled for the workplace as a whole or for individual work areas);

3. a description of the labeling systems or other forms of warning utilized in the workplace;

4. the methods the employer will use to inform employees of the hazards of infrequent or non-routine tasks that involve exposure to hazardous substances, harmful physical agents, or infectious agents;

6. the methods the employer will use to inform employees of the hazards associated with hazardous substances contained in unlabeled pipes in their work areas.

C. In addition to the above information, multi-employer workplace employers must include a description of the following in their written ERTK programs:

1. the methods the employer will use to inform other employers with employees working at the workplace of the hazardous substances, harmful physical agents, or infectious agents employees may be exposed to while performing their work;

2. the methods the employer will use to provide other employers with a copy of the MSDS or other written information, or how it will be made available in the workplace (e.g., a central location) for each substance or agent the other employer's employees may be exposed to while working in the facility;

3. the methods the employer will use to inform other employees of required precautionary measures that must be taken during normal operating conditions and in foreseeable emergencies; and

4. the methods the employer will use to inform the other employers of the labeling system used in the workplace.

D. Employers whose employees are exposed to bloodborne pathogens as part of their job duties are required to develop and implement an Exposure Control Plan under 1910.1030. If the employer includes <u>all</u> infectious agents to which employees may be exposed in the Exposure Control Plan, and that plan meets the requirements of 1910.1030, the ERTK requirement for a written program for infectious agents will have been met.

E. The written ERTK program must be maintained at the worksite at all times and <u>must be available upon request</u> to employees, their designated representatives, and MNOSHA.

F. <u>Citation Guidelines/Written ERTK Program.</u>

1. ~~Cite 5206.0700, subpart 1(B) when an employer has not developed and implemented a written program but is exposing employees to hazardous substances, harmful physical agents, or infectious agents which are present in the workplace.~~

   Where employees are exposed or potentially exposed to a hazardous substance, harmful physical agent, or infectious agent, and labeling, MSDS, chemical inventory, and training requirements are met, but there is no written plan, no citation shall be issued.

~~2. Cite 5206.0700, subpart 1(B) when an employer's written program exists but is found to be deficient.~~

2. When an employer's written program exists but is found to be deficient and there are other ERTK program deficiencies, cite 5206.0700, subpart 1(B), grouped with the applicable section of the ERTK standard which covers the other deficiency.

3. Cite 5206.0700, subpart 1(C) when an employer in a multi-employer workplace does not provide other employers on the site with required ERTK information.

4. Where there is an overlap in the written program requirements between ERTK and another standard (e.g., bloodborne pathogens, noise, etc.), and a deficiency in the written program is covered by both standards, cite the more specific standard.

EMPLOYEE INFORMATION AND TRAINING.

A. The ERTK standard requires employers to provide training "at no cost to employees." Therefore, training must be conducted during the employees' regularly scheduled work times. If employees are required to attend training at a time other than their normal work schedule, they must be compensated for that time (e.g., overtime, equivalent time off, etc.).

B. The training requirements of ERTK will generally complement rather than satisfy the existing training requirements of other OSHA standards (i.e., expanded health standards, etc.)

1. Training programs must be evaluated through program review, discussions with management, and employee interviews. All elements of training and information stated in the standard must be addressed. The following additional questions provide a general outline of topics to be reviewed:

a. Has a training and information program been established for employees exposed to hazardous substances, harmful physical agents, and infectious agents?

b. Is this training provided before initial assignment?

c. Is training provided whenever a new hazard is introduced into work areas?

d. Is annual update training given?

2. Employee interviews will provide general information to the OSHI regarding the training program; employees must be aware of what hazards they are exposed to, know how to obtain and use information on labels, MSDSs, or other reference materials, and know and follow appropriate work practices. However, if the OSHI detects a trend in employee responses that indicates training is not being conducted, or is conducted in a cursory fashion that does not meet the intent of the standard, a closer review of the written program and its implementation may be necessary.

3. The current employer is responsible for ERTK employee training. ERTK training must be worksite specific. If a substance covered by ERTK is available for use and employees are expected to use it or work in an environment where it is used or exists, then training must be provided.

4. Giving an employee a data sheet, package insert, reference manual, or other printed material to read, or having them sit and watch a video does not meet the ERTK training requirements. Training is to be a forum for explaining to employees not only the hazards in their work area, but also how to use the ERTK information.

   a. Audiovisuals, interactive video, printed materials, etc. may be used as part of the program but must be supplemented by specific information related to the employees' job duties and related exposures.

   b. Training shall include an opportunity for employees to ask questions to ensure that they understand the information presented to them.

5. Employers are required to make a written copy of the information required for training "readily accessible" in the area where hazardous substances, harmful physical agents, or infectious agents are used or handled. This will generally be accomplished through a written document (e.g., MSDSs, infectious disease reference manual, etc.).

   a. "Readily accessible" means that the information is convenient to, or nearby, the employee's work area and can be easily obtained by the employee without delay.

   b. Access to a computer terminal, microfiche machine, or other display device is acceptable as meeting the requirement for written information in the workplace if employees are trained in the use of the terminal or other device and can easily access the information during the workshift.

   c. If information is made available to employees in the workplace by computer, a hard copy printout of the information must be made available to an employee who requests it within 24 hours of the request (excluding nonworkdays).

6. Employers who use a small number of substances, may decide to conduct training by going through the MSDS for each substance. Employers with a large number of substances may decide to train on specific exposure hazards, common hazards of a broad class of substances or agents, hazards of a complete production operation, or any other grouping of similar information.

7. Training must be provided in a manner that can be reasonably understood by the employees. If employees must receive job instructions in a language other than English, then ERTK training and information must also be conducted in that language.

8. Temporary, seasonal, and part-time workers who are assigned to tasks which could potentially expose them to hazardous substances, harmful physical agents, or infectious agents must also be included in the training program.

9. Technically qualified individuals (TQIs) are exempt from ERTK training. However, employers must notify TQIs when training will be conducted for other employees and allow the TQIs to attend if they wish. If TQIs choose to attend ERTK training, they must be paid for the time they spend at ERTK training.

C. Frequency.

1. Employees are to be trained before initial assignment to a job where there is a reasonable potential for exposure to a hazardous substance, harmful physical agent, or infectious agent during the course of assigned work. The intent of this provision is to have information prior to exposure to prevent the occurrence of adverse health effects. This purpose cannot be met if training is delayed until a later date.

2. Employees must also be trained before being exposed to any new or additional hazardous substance, harmful physical agent, or infectious agent.

3. ERTK training must be **updated at least annually**. Update training may be brief summaries of information previously included in ERTK training.

D. Training Records.

1. Employers are required to maintain records of training and retain those records for three years. Training records must be maintained at the worksite and made available, upon request, for review by employees and MNOSHA. Records may be kept in whatever format or medium (i.e., paper, computerized, etc.) the employer chooses as long as the elements listed in Item 2 (a. to d.) below are included in the records and the information is available to employees and MNOSHA when requested.

2. Training records must include the following information:

   a. the dates training was conducted

   b. the name, title, and qualifications of the person who conducted the training,

   c. the names and job titles of employees who completed the training, and

   d. a brief summary or outline of the information that was included in the training session.

E. Right to Refuse to Work. Employees may no longer refuse to work simply because ERTK training has not been provided. The right to refuse to work under imminent danger conditions, however, remains in effect.

F. Citation Guidelines/Training.

1. Cite 5206.0700, subparts 1 and 2, 3, or 4, when training was not conducted or was found to be inadequate or incomplete.

2. Cite 5206.0700, subpart 1(D), if records of training are not maintained or are incomplete.

3. Cite 5206.0700, subpart 1(G) if training is not provided before initial assignment, when new hazards are introduced into the workplace, or annual update training is not provided.

4. Cite 5206.0700, subpart 1(J) if TQIs are not notified of ERTK training or are not allowed to attend.

HAZARDOUS SUBSTANCES:

A. General.

1. The list of hazardous substances included in 5206.0400 is not all inclusive and does not include all hazardous substances that exist. The list is updated every two years adding new substances and updating current listings to reflect changes reported by ACGIH, AIHA, NIOSH, OSHA, NTP and IARC.

2. Employers must use reasonable diligence in evaluating their workplaces to determine what hazardous substances exist. The fact that a particular hazardous substance is not listed in subpart 5 of 5206.0400 does not exempt the employer from including it in the ERTK program.

3. Subpart 4 of 5206.0400 lists several reference documents that include information on hazardous substances. Substances on the list are coded to these reference documents to help employers locate information on each substance.

4. Appendix A to this instruction, "Materials Commonly Used in Construction," is a list of the most common toxic substances, including their associated hazards and classes, that can be found on construction sites.

B. Eleven categories of substances or mixtures, are defined in 5206.0400, subpart 2, as exempt from the requirements of ERTK including:

1. Products which employees bring into the workplace for their own personal use;

2. Consumer products if used in a manner that is comparable to the typical consumer use. [If the product is used with greater frequency, in stronger concentrations, or for longer duration than would be expected in normal consumer use, it must be included in the ERTK program];

[See Appendix A of Federal OSHA Instruction CPL 2.111 for the elements that should be documented in the case file for an ERTK violation which involves exposure to a consumer product.]

3. Articles (e.g., equipment, hardware, etc.) which contain a hazardous substance in solid form but do not release the substance or otherwise create a health hazard as a result of handling;

4. Substances that are bound and not released under normal conditions of work or in a reasonably foreseeable occurrence (e.g., adhesive tape, vinyl upholstery, tires, etc.). [However, if the process in which the item will be used involves cutting, burning, etc., that could result in employee exposure to a hazardous chemical, it does not qualify for this exemption];

5. Products sold or used in retail establishments; [the frequency and duration of use is the determining factor in whether or not an employer must cover a product purchased in a retail store];

6. Waste material regulated under the Resource Conservation and Recovery Act (RCRA) that is collected, processed, or disposed of by a waste service employer;

7. Other waste products that are labeled pursuant to RCRA but disposed of by means other than collection and disposal by a waste hauler; employers must make sure that waste hazardous substances that are mixed together in the same container are compatible;

8. Substances that remain in sealed packages and are not opened; [Handling sealed, intact packages involves no exposure to hazardous substances. This exemption is intended to relieve warehouses and other storage-type facilities from the need to have MSDSs for everything stored or transported through their facilities. These employers should, however, have established procedures for dealing with leaks, spills, or other emergencies.]

9. Substances present in a physical state, volume, or concentration for which no valid substantial evidence that a significant risk to human health may occur from exposure; [this exemption applies to very small quantities or releases of trace amounts, solids, and very diluted substances that present no adverse health affects];

10. Liquor and food.

C. Availability of Information/Material Safety Data Sheets.

1. The standard requires manufacturers of hazardous substances or mixtures of hazardous substances to provide employers who use their products with complete, up-to-date MSDSs (Minnesota Rule 5206.0800, subpart 1a). The term "manufacturer" includes anyone who produces, synthesizes, extracts, or otherwise makes, processes, blends, packages, or repackages a hazardous substance or equipment which generates a harmful physical agent and includes importers and distributors of these products.

2. MSDSs must be current, accurate, and complete and must be provided at the time of the first shipment and whenever the information on the MSDS is revised. The MSDS need not be sent with each shipment to the same purchasing employer as long as the information on the original MSDS remains current.

3. OSHIs must determine that MSDSs have been obtained for all hazardous chemicals used by the employer and review those MSDSs for completeness. The number of MSDSs selected for review will depend on the number of chemicals used in the workplace, the severity of the hazards involved, the completeness of the MSDSs in general, and the volume of chemicals used. It is not necessary to review every MSDS. A guide for reviewing the completeness of MSDSs is in Appendix B of this instruction.

4. Federal OSHA Form 174 is a non-mandatory MSDS form that includes spaces for all required information. If the employer chooses another format, the information required on OSHA Form 174 must be included. (See Appendix C for a sample OSHA Form-174.) To be acceptable under ERTK, the MSDS must include all required information as defined in 1910.1200.

5. MSDSs or equivalent written documentation (e.g., computer form, display terminal, etc.) containing all information that would normally be found on a MSDS must be available in location for the hazardous substances used at the worksite.

NOTE: It is suggested, but not required, that the controlling employer or general contractor have all other employers and/or subcontractors locate the necessary MSDSs in one central accessible location on the worksite.

6. If MSDSs have not been obtained by the employer, or have been obtained but are incomplete (e.g., missing information required for training under 5206.0700, subpart 2), the OSHI shall advise the employer to contact the manufacturer/supplier to request that the missing information or missing MSDS be provided within 30 days. If complete information is not received from the manufacturer within 30 days, the employer must contact Minnesota OSHA for an extension and assistance in obtaining the information or be subject to possible failure to abate penalties.

   a. If the employer requests MNOSHA's assistance in obtaining the information, the OMT Director in whose area the employer is located shall contact the manufacturer responsible for the incomplete MSDS.

   b. If the employer has evidence that previous attempts have been made to obtain the information (e.g., a copy of a letter to the manufacturer, documentation of phone calls to the supplier, etc.) or if the employer does not receive the information within the abatement period, the OMT Director shall send a certified letter to the supplier or manufacturer to obtain the completed MSDS

   c. If a Minnesota supplier or manufacturer fails to respond to phone and letter requests, an OSHA-90 referral form shall be completed and forwarded to the appropriate Area Office for inspection.

   d. If an out-of-state supplier or manufacturer fails to respond within a reasonable time (e.g., 30 days), a referral shall be made by the OMT Director to the Regional Office or the appropriate State Plan OSHA Office within whose jurisdiction the supplier or manufacturer is located.

7. The MSDS requirements apply to free samples provided by chemical manufacturers and importers since the hazards remain the same regardless of the cost to the employer.

8. Material Safety Data Sheets for Drugs. Most drugs come with a package insert that, in some instances, includes the same information as a MSDS. In addition, a publication known as the "Physicians Desk Reference (PDR)" contains information about drugs. The question employers often ask is whether or not a separate MSDS is required for these drugs. Because ERTK requires employers to maintain a "written document" that contains the information required for training, but does not specify that it must be a MSDS, MNOSHA's policy concerning MSDSs for drugs is as follows:

   a. In those situations where employees are required to handle or mix drugs in powder or liquid form in the course of their assigned job responsibilities, a package insert is acceptable in lieu of the MSDS if it includes all required information needed for training as outlined in 5206.0700, subpart 2.

b. The Physicians Desk Reference (PDR) does not contain enough information on most drugs to meet the training requirements of the ERTK standard; therefore, the PDR is **not an adequate replacement and cannot be used in lieu of a MSDS**.

c. MSDSs are required for drugs which are not in final form and do not have package inserts that provide the information needed for training.

9. Requests for assistance in obtaining MSDSs from Federal OSHA, other State plan states, or from employers other than those involved in an inspection shall be referred to the Management Analyst/Standards for processing in accordance with paragraphs 5 c and d.

D. Labeling.

1. Original shipping containers. Labels or other markings on each container of hazardous substances must include the identity of the hazardous substance, appropriate hazard warning, and the name and address of the chemical manufacturer, importer, or other responsible party. The label may also include a coded reference to the appropriate MSDS.

NOTE: "Hazard warning" refers to the specific hazards of the substance and is intended to include the target organ effects. Phrases such as "caution" or "danger" are precautionary statements, not hazard warnings.

a. Labels must be in English but may also be printed in other languages.

b. The accuracy of label information is to be assessed for a representative number of substances. The OSHI shall determine whether the label identity can be matched with the MSDS and the list of hazardous substances.

c. OSHIs must consider alternate labeling provisions (e.g., tags or markings) for containers which are too small to accommodate a legible label.

d. OSHIs shall evaluate the effectiveness of inplant labeling systems through a review of the employer's training program and MSDS procedures, including employee interviews to determine their familiarity with the system.

2. Accepted Labels. Labels that meet the requirements for labeling under certain federal regulations meet the intent of ERTK. Employers are not required to "relabel" shipping containers that are properly labeled in accordance with the following regulations:

a. pesticides labeled according to the Federal Insecticide, Fungicide and Rodenticide Act;

b. foods, food additives, color additives, drugs, or cosmetics including materials intended for use as ingredients in these products labeled according to the Federal Food, Drug, and Cosmetic Act;

c. distilled spirits (beverage alcohols), wine, or malt beverage labeled in accordance with the Federal Alcohol Administration Act;

d. consumer products as defined in the Consumer Product Safety Act and labeled according to its requirements;

e. any hazardous substance as defined in the Federal Hazardous Substances Act and labeled in accordance with that act.

3. Pipelines. Pipelines, pipes, and piping systems are not covered by the labeling requirements of ERTK. However, employers must train employees in the hazards associated with substances in unlabeled pipes in their work areas.

4. Bulk transport. Hazardous substances transported in bulk must be labeled according to the requirements of ANSI or the federal Department of Transportation Standard for Transportation of Hazardous Substances.

a. If a hazardous substance is shipped by tank truck, rail car, or other vehicle and the "label information" is posted on the tank or vehicle or attached to the accompanying shipping papers or bill of lading, the employer purchasing the substance must ensure that employees are aware of the label warning before potential exposure to incoming substances occurs.

b. A label may not be shipped separately, even if it is prior to shipment of the hazardous substance since this defeats the intended purpose of this requirement which is to provide an immediate hazard warning. Mailing labels directly to purchasers will bypass those employees involved in transporting the hazardous chemical.

5. Containers. A "container" under ERTK is any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. Except as noted above, all containers must be labeled, tagged, or marked with at least the identity of the hazardous chemical or chemicals it contains, and the appropriate hazard warnings.

a. For individual stationary process containers, employers may use signs, placards, process sheets, batch tickets, operating procedures, or other written materials in lieu of affixing labels to the container as long as the alternative method identifies the container to which it applies and includes at least the identity of the substance in the container and the appropriate hazard warning.

b. Immediate use containers (test tubes, beakers, graduates, vials, pitchers, pails, roofer's melt pot, cauldron, buggy, or similar containers which are routinely used and reused) do not have to be labeled. However, to qualify as an "immediate use container" and, therefore, not be subject to the labeling requirements of ERTK, the container must be used only to transfer a hazardous substance from a labeled container, remain under the control of the person who transferred the substance, and only be used during the work shift in which the transfer takes place.

E. Hazardous Substances Training.

1. ERTK requires training of all employees routinely exposed to hazardous substances. Training must include all of the information described in a. through j. below:

a. the name or names of substances, including any generic or chemical name, trade name, and commonly used name;

b. the level, if known, at which exposure to the substance has been restricted or, if no standard has been adopted, according to guidelines established by competent professional groups;

c. known acute (extremely severe, reaching crisis rapidly) and chronic (prolonged, lingering) effects of exposure at hazardous levels, including routes of entry;

d. known symptoms;

e. any potential for flammability, explosion, or reactivity of the substance;

f. appropriate emergency treatment;

g. known proper conditions of use and exposure to the substance;

h. procedures for cleanup of leaks and spills;

i. the name, phone number, and address of a manufacturer of the hazardous substance;

j. a written copy of all of the above information which shall be readily accessible in the area or areas in which the hazards substance is used or handled.

2. Training need not be conducted on each specific chemical found in the workplace, but may be conducted by categories of hazards (e.g., carcinogens, sensitizers, acutely toxic agents). This approach to training may be especially useful when training employees about the types of hazards they may encounter at another employer's worksite.

3. Employees who work in operations where they handle only sealed containers (such as warehousing) are potentially exposed to hazardous substances and, therefore, need access to information as well as training. The training required for employees who handle sealed containers is dependent upon the type of chemicals involved, the potential size of any spills or leaks, the type of work performed and what actions employees are expected to take when a spill or leak occurs.

F. Trade Secrets.

1. If a manufacturer considers the name or identity of a hazardous substance to be proprietary information, it may be registered as a trade secret with MNOSHA.

2. Formulations and procedures are automatically considered to be trade secret and need not be registered.

3. Only the name of a hazardous substance may be registered as a trade secret; all other information required on the MSDS must be provided. If a manufacturer chooses to register

the name of a hazardous substance as trade secret, that manufacturer must submit the following information to MNOSHA:

a. the name or names of the substance including any generic or chemical name, trade name, commonly used name, and the CAS number for the substance;

b. a description of why the substance is a trade secret;

c. a description of the product which contains the hazardous substance and what that product is used for;

d. a complete MSDS listing all components of the product including proprietary as well as non-proprietary ingredients, the percentage of each, and required precautions and procedures;

e. a second MSDS for the product that will be given to the purchaser; [this MSDS must provide all precautionary as well as other required information with the exception of the identity of the trade secret ingredient's name.]

f. the name, address, and phone number for a contact person should additional information be required.

G. Citation Guidelines/Hazardous Substances.

1. Cite 5206.0700, subpart 1 and 2 if hazardous substance training has not been conducted or was incomplete.

2. Cite 5206.1000, subpart 4, if training has not been provided to employees on hazardous substances in pipelines in the facility.

3. Cite 5206.1000, subparts 1 and 7, for missing, inadequate, or illegible labels.

4. Cite 5206.0800, subpart 1, for lack of MSDSs or if MSDSs are incomplete (e.g., missing information required for training under 5206.0700, subpart 2).

5. Cite 5206.0800, subpart 1a, if a supplier or manufacturer fails to provide complete, accurate MSDSs.

HARMFUL PHYSICAL AGENTS.

A. ERTK restricts coverage of harmful physical agents to only four (heat, noise, ionizing radiation, and non-ionizing radiation) because, by definition, harmful physical agents are those physical agents "determined by the commissioner **as part of the standard** for that agent to present a significant risk to worker health or safety or imminent danger of death or serious physical harm to an employee." In other words, to cover an agent under ERTK, a separate standard for that agent must be adopted. The four physical agents currently covered by ERTK include heat, noise, ionizing and non-ionizing radiation.

1. **Heat.** Heat-related health problems result from a combination of internal (body) heat production from doing work and external heat exposure (environment). Heat disorders include heat stroke, heat exhaustion, heat cramps, fainting, and heat rash. Employee education is vital so that workers are aware of the need to replace fluids and salt lost through sweat; can recognize dehydration, exhaustion, fainting, heat cramps, salt deficiency, heat exhaustion, and heat stroke as heat disorders; and know the means of protecting themselves.

   For general industry, the standard which makes heat subject to ERTK coverage is Minnesota Rule 5205.0110, subpart 1, "Temperature and Humidity Table." This standard is based on effective temperature, and considers season of the year and work activity. If the effective temperature limit is approached or exceeded, ERTK training requirements apply.

   In construction, no specific heat standard has been adopted in the 1926 standards so heat as a harmful physical agent subject to ERTK training cannot be applied to construction. However, 1926.21(b) requires employers to "...instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." Training in the effects of heat and how to avoid heat stroke, heat exhaustion, etc., should be part of this training. If a construction employer has not included heat information in the training program provided to employees, a violation of 1926.21(b) exists.

2. **Noise.** Standards governing noise exposure exist for general industry (1910.95) and for construction (1926.52). These standards require employers to protect all workers from occupational noise exposure that exceeds an 8-hour time-weighted average (TWA) of 90 decibels (dBA). Employers must monitor noise exposure, institute control measures, and implement a hearing conservation program when exposures exceed an 8-hour TWA of 85 DBA. When noise levels meet or exceed the permissible limits established in these standards, ERTK training must be provided to educate employees in safe levels of noise, potential areas of over-exposure, effects of noise on their health, use of personal protective equipment, etc.

3. **Ionizing Radiation.** Federal OSHA Standards 1910.96 and 1926.53 which cover ionizing radiation have been adopted by Minnesota OSHA. Whenever employee exposures approximate or exceed the exposure limits established by these standards, ERTK requirements for harmful physical agents must be met. Some of the most common uses of ionizing radiation occur in hospitals and dental offices with X-ray equipment and radioactive sources for patient treatment and in general industry with non-destructive testing.

4. **Non-ionizing radiation.** Because Federal OSHA standards 1910.97 and 1926.54 have been adopted by Minnesota OSHA, certain frequencies of non-ionizing radiation are covered under ERTK. Whenever employee exposure is expected to approximate or exceed the exposure limit established by these standards, the ERTK training requirements must be met. Possible sources of non-ionizing radiation include lasers used in construction, radio frequency (RF) microwave heaters, and communications systems. [NOTE: UV and IR wave lengths are not included in 1910.97.]

B. Availability of Information and Labeling.

1. Manufacturers of equipment which generate a harmful physical agent must provide the purchasing employer with the information necessary for that employer to comply with the

training requirements of 5206.0700, subpart 3. The information must be provided at the time of purchase and be current, accurate, and complete.

2. Employers must provide written information to employees who may be exposed to one or more of these physical agents at a level which may be expected to approximate or exceed the permissible exposure limit or the applicable action level.

3. Employers must label equipment or work areas that generate harmful physical agents at a level which may be expected to approximate or exceed the permissible exposure limit or applicable action level with at least the name of the physical agent and the appropriate hazard warning. For example, warning signs may be appropriate in areas where radiation exposure due to lasers is possible or in areas that are particularly hot or noisy.

C. Harmful Physical Agents Training.

1. Employers must conduct initial and on-going evaluations to determine if employees are routinely exposed to harmful physical agents at levels which approximate or exceed the permissible exposure limit or applicable action level and provide training to those employees.

2. Training must be provided so that it is understood by the employees and must include the information required by the standard for the agent or agents, including the following:

   a. the name or names of the physical agent including any commonly used synonym;

   b. the level, if known, at which exposure to the physical agent has been restricted or, if no standard has been adopted, according to guidelines established by competent professional groups;

   c. the known acute (extremely severe, reaching crisis rapidly) and chronic (prolonged, lingering) effects of exposure at hazardous levels;

   d. known symptoms;

   e. appropriate emergency treatment;

   f. known proper conditions for exposure to the physical agent;

   g. the name, phone number, and address, if appropriate, of a manufacturer of the equipment which generates the harmful physical agent; and

   h. a written copy of all of the above information which shall be readily accessible in the area or areas in which the harmful physical agent is present and where the employees may be exposed to the agent through use, handling, or otherwise.

D. Citation Guidelines/Harmful Physical Agents.

1. Cite 5206.0700, subparts 1 and 3, if training on harmful physical agents was not conducted or was incomplete. [For construction, cite 1926.21(b) for failure to provide training on heat exposure.]

2. Cite 5206.1100 if areas or equipment that generate a harmful physical agent are not labeled or are inadequately labeled.

3. Cite 5206.0800, subpart 1, if written information on harmful physical agents is not available to employees.

INFECTIOUS AGENTS:

A. Infectious agents apply to all employers who have employees potentially exposed to infectious agents. This means that infectious agents training must be provided by employers who have a first aid or first responder team, in correctional facilities and group homes, to firefighters and law enforcement personnel, etc.

B. Infectious agents list.

1. The list of infectious agents included in 5206.0600, subpart 4, includes the most common infectious agents that may be encountered in Minnesota. The list is compiled using information from the sources listed in subpart 3 and is reviewed by specialists in the Minnesota Department of Health before publication. The list is not all inclusive, however, and employers must still exercise reasonable diligence in evaluating their workplaces for the presence of other recognized infectious agents.

2. The statutory definition of "infectious agents" limits infectious agents in 5206.0600, subparts 4 through 8, to bacterial, viral, fungal, parasitic, and rickettsial agents.

C. Availability of Information.

1. The written information requirement for infectious agents can be met if the employer makes reference documents available in work areas for employees' information. Documents such as "Control of Communicable Disease in Man" that provide all of the information required for infectious agents training (5206.0700, subpart 4) are acceptable as meeting this requirement.

D. Infectious Agents Training.

1. The information required to be presented as part of the training program for infectious agents was amended in 1992 to coincide with the training required for bloodborne pathogens under 1910.1030. This change allows employers to conduct one training program that covers all infectious agents and have that program satisfy the requirements of ERTK and 1910.1030.

NOTE: Although the construction employers are exempt from 1910.1030, they are not exempt from ERTK infectious agents training where it may apply.

2. ERTK requires training of all employees routinely exposed to infectious agents. Training does not have to be provided on all infectious agents but must cover the most commonly found agents. The training program must include:

   a. a general explanation of the epidemiology and symptoms of infectious diseases including hazards to special at-risk employee groups;

   b. an explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to infectious agents including blood and other infectious materials;

   c. an explanation of the chain of infection, or infectious disease process, including agents, reservoirs, modes of escape from reservoir, modes of transmission, modes of entry into host, and host susceptibility;

   d. an explanation of the employer's exposure control program;

   e. an explanation of the use and limitations of methods of control that will prevent or reduce exposure including universal precautions, appropriate engineering controls and work practices, personal protective equipment, and housekeeping;

   f. an explanation of the basis for selection of personal protective equipment, including information on the types, proper use, location, removal, handling, decontamination, and disposal of personal protective equipment;

   g. an explanation of the proper procedures for cleanup of blood or body fluids;

   h. an explanation of the recommended immunization practices, including, but not limited to the HBV vaccine and the employer's methodology for determining which employees will be offered the HBV vaccine, and the efficacy, safety, and benefits of being vaccinated;

   i. procedures to follow if an exposure incident occurs, method of reporting the incident, and information on the post-exposure evaluation and medical follow-up that will be available;

   j. information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;

   k. an explanation of the signs, labels, tags, or color coding used to denote biohazards;

   l. an opportunity for interactive questions and answers with the person conducting the training session;

   m. an accessible copy of the regulatory text of the ERTK standard and an explanation of its contents; and

n. how to gain access to further information and reference materials that must be made available in the workplace including the location, contents, and availability of pertinent materials that explain symptoms and effects of each infectious agent.

E. Citation Guidelines/Infectious Agents.

1. Cite 5206.0700, subparts 1 and 4, if infectious agents training was not conducted or was incomplete.

2. Cite 1910.1030(g)(2)(i) if infectious agents training was conducted but bloodborne pathogens training was not done.

3. Cite 5206.0800, subpart 1, if written information on infectious agents was not available to employees.

INTERFACE WITH OTHER STANDARDS:

In some cases, an employer's duties under other OSHA standards coincide with requirements of ERTK resulting in simplified compliance.

A. Medical Records Access. The Access to Employee Exposure and Medical Records standard (1910.20) and ERTK overlap with regard to MSDSs. MSDSs are specifically identified as exposure records under 1910.20(c)(5)(iii). Each MSDS received by an employer must be maintained for at least 30 years as required by 1910.20(d)(1)(ii). However, the access standard does offer an alternative to keeping the MSDSs in 1910.20(d)(1)(ii)(B). MSDSs or other records concerning the identity of a substance or agent need not be retained for any specified period as long as some record of the identity (chemical name if known) of the substance or agent, where it was used, and when it was used is retained for at least 30 years. To simplify the maintenance of this information, an employer may wish to include information on where chemicals were used and when they were used on the hazardous substance list that is part of their ERTK programs. This list, then, can be kept for 30 years to meet the retention requirements of 1910.20.

B. Occupational Exposure to Hazardous Chemicals in Laboratories. Quality control laboratories are usually part of production operations and are not covered under the Laboratory Standard (1910.1450), but must comply with ERTK. Other laboratories covered by 1910.1450 are exempt from ERTK.

C. Hazardous Waste Operations and Emergency Response. The scope and extent of training regarding emergency procedures and emergency response will depend upon the response of employees to an emergency. If the employer intends to evacuate the work area, the training in emergency procedures can be quite simple but should include information on the emergency alarm system and evacuation routes. However, if employees are expected to take action to moderate or control the emergency, then additional training will be required. At a minimum, training should include appropriate personal protective equipment, leak and spill cleanup, decontamination, shut-down procedures, and where to go in an emergency. See 29 CFR 1910.120 for further information on post-emergency response training.

D. Occupational Exposure to Bloodborne Pathogens. Bloodborne pathogens are one type of infectious agent. Employers who must develop and implement an exposure control plan as required by the Bloodborne Pathogens Standard (1910.1030) may extend that plan to include similar information for all infectious agents to which employees are actually or potentially exposed. Exposure control plans that meet the requirements of 1910.1030 and cover all infectious agents will be considered as meeting the intent of ERTK. If the exposure control plan is a separate document from the employer's ERTK program, a reference to the plan should be made in the ERTK program.

E. Other Health Standards. Labeling requirements in substance-specific standards take precedence over the labeling requirements of ERTK. For example, the ethylene oxide (ETO) standard has a different labeling requirement than ERTK.

Darrell E. Anderson, OMT Director
for the OSHA Management Team

Distribution: Assistant Commissioner, OMT, all OSHIs, Complaint Desk, all Administrative, Technical, Clerical, and IMIS Staff, Federal OSHA, Attorney General's Office, Legal Services, and OSHA Consultation.

Attachments: Appendix A--Materials Commonly Used in Construction
Appendix B--Guide for Reviewing MSDS Completeness
Appendix C--Sample OSHA-174 Form

APPENDIX A
MATERIALS COMMONLY USED IN CONSTRUCTION

	PHYSICAL HAZARDS		HEALTH HAZARDS		
Material Class	**Flammables/ Combustibles**	**Compressed Gas**	**Respiratory**	**Irritant**	**Corrosive**
Solvent Based Paint, thinners, strippers	X		X		
Mastics and Adhesives glues	X		X	X	
Pipe Joint Compound PVC cements	X		X	X	
Sealants	X		X	X	
Cleaning Solvents	X		X		
Soldering fumes, Lead	X		X		
Welding fumes, rod contents, effects of rays	X		X	X	
Oxygen acetylene, nitrogen	X	X			
Nuisance dust, Particulates			X	X	
Silica, abrasives			X		
L P GAS	X	X			
Carbon Monoxide			X		
Portland Cement mortars, related ingredients				X	X
Lye, hydroxides					X
Muriatic sulfuric, hydrochloric, acids					X
Motor oils, hydraulic fluids, gasoline	X			X	

APPENDIX B

GUIDE FOR REVIEWING MSDS COMPLETENESS

NOTE: This guide is an optional aid for reviewing MSDSs during inspections.

During OSHI review of material safety data sheet (MSDS) completeness, the following questions should be considered:

1. Are all sections of the MSDS completed?

   NOTE: All blocks on the MSDS must be completed. However, employers are free to develop MSDSs in any format they wish as long as the MSDSs contain the required information.

2. Do chemical manufacturers and importers have an MSDS for each hazardous chemical produced or imported into the United States?

   NOTE: Chemical manufacturers, distributors, and importers who choose to purchase data sheets for their products from information services, rather than developing the MSDS themselves, retain responsibility for providing the sheets and for assuring their accuracy.

3. Do employers have an MSDS for each hazardous chemical used?

   NOTE: Employers who in good faith choose to rely on the MSDSs provided to them by the chemical manufacturer or importer assume no responsibility for their contents. They are, however, responsible for assuring that all required information is included on the MSDS.

4. Is each MSDS in at least English?

   NOTE: This requirement is intended to prevent importers from transmitting MSDSs written in a foreign language. It does not prohibit the translation of MSDSs into foreign languages to aid employee understanding.

5. Does the MSDS include at least the following:

   a. Identity used on the label?

   b. Chemical and common names of the hazardous ingredients?

   c. For mixtures tested as a whole:

      i. Chemical and common names of the ingredients which contribute to the known hazards?

      ii. Common names of the mixture itself?

   d. For mixtures not tested as a whole:

i. Chemical and common names of all ingredients which are health hazards [1 percent concentration or greater], including carcinogens [0.1 percent concentration or greater]?

ii. Chemical and common names of all ingredients which are health hazards and pose a risk to employees, even though they are present in the mixture in concentrations of less than 1 percent or 0.1 percent for carcinogens?

NOTE: For mixtures, if the employer is assuming the mixture has the same hazards as its hazardous components (i.e., no test data on the mixture as a whole), the MSDSs for the components will satisfy the requirements for a data sheet for the mixture. These MSDSs must be attached to one another and identified in a manner where they can be cross-referenced with the label. This approach is acceptable provided the MSDSs include the PEL, TLV, and other exposure limits for <u>each</u> ingredient that is determined to be a health hazard.

e. Chemical and common names of all ingredients which have been determined to pose a physical hazard when present in the mixture?

f. Physical and chemical characteristics of the hazardous chemical (vapor pressure, flashpoint, etc.)?

g. Physical hazards of the hazardous chemical including the potential for fire, explosion, and reactivity?

h. Health hazards of the hazardous chemical (including signs and symptoms and medical conditions that may be aggravated)?

i. Primary routes of entry?

j. OSHA permissible exposure limit (PEL)? The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)? Other exposure limits (including ceiling and other short-term limits)?

k. Information on carcinogen listings [reference OSHA regulated carcinogens, those indicated in the National Toxicology Program (NTP) Annual Report on Carcinogens, and/or those listed by the International Agency for Research on Carcinogens (IARC)]?

NOTE: Negative conclusions regarding carcinogenicity, or the fact that there is no information, do not have to be reported unless there is a specific space or blank for carcinogenicity on the form. However, if the format used provides a space for a carcinogen entry, one must be made since no blank spaces may be present on the MSDS.

l. Generally applicable procedures and precautions for safe handling and use of the chemical?

m. Generally applicable control measures?

n. Pertinent emergency and first aid procedures?

o. Date the MSDS was prepared or the date of the last change?

p. Name, address, and telephone number of the responsible party?

6. New or significant information must be added to the MSDS within three months.

[Reference: Federal OSHA Instruction CPL 2-2.38C]

Appendix E

Lead
MSDS and Reference Information

Modified Material Safety Data Sheet
Lead (Pb)

Section I
(manufacturer's name and address)(emergency telephone numbers)(person prepared and date)
CAS: 7439-92-1

Section II - Hazardous Ingredients/Identity Information
(specific chemical name)(OSHA PEL)(ACGIH TLV)(other limits)(%)
Lead (Pb) $0.05 mg/m^3$ $0.15 mg/m^3$

Section III - Physical/Chemical Characteristics
(boiling point: 1740°F)(specific gravity)(vapor pressure: 1 mm@973°F)(melting point: 327.43°F)
(vapor density)(evaporation rate)(solubility in water)(appearance and odor: bluish-gray, soft metal)

Section IV - Fire and Explosion Hazard Data
(flash point)(flammable limits, LEL, UEL)(extinguishing media)(special fire fighting procedures)
Flammable in the form of dust when exposed to heat or flame. Moderately explosive in the form of dust when exposed to heat or flame. Mixtures of hydrogen peroxide + trioxane explode on contact with lead.

Section V -Reactivity Data
(stability)(conditions to avoid)(incompatibility)(hazardous decomposition)(hazardous polymerization)(conditions to avoid) Violent reaction on ignition with chlorine trifluoride; concentrated hydrogen peroxide; ammonium nitrate(below 200°C with powdered lead); sodium acetylide(with powdered lead). Incompatible with NaN_3; Zr; disodium acetylide; oxidants. Can react vigorously with oxidizing materials. When heated to decomposition it emits highly toxic fumes of Pb.

Section VI - Health Hazard Data
(routes of entry - inhalation: of dust, fumes, mists, or vapors; skin: organic compounds of lead, as lead tetraethyl; ingestion: lead compounds trapped in the upper respiratory tract or introduced into the mouth on food, tobacco, fingers or other objects.)(acute)(chronic)(carcinogenicity)(signs and symptoms or exposure)(medical conditions)(emergency and first aid procedures) An experimental teratogen. Experimental reproductive effects. Human mutagenic data. Lead is a cumulative poison. Increasing amounts build up in the body and eventually reach a point where symptoms and disability occur. When lead is ingested, mush of it passes through the body unabsorbed, and is eliminated in the feces. The greater portion of the lead that is absorbed is caught by the liver and excreted, in part, in the bile. For this reason, larger amounts of lead are necessary to cause toxic effects by this route, and a longer period of exposure is usually necessary to produce symptoms. On the other hand, upon inhalation, absorption takes place easily from the respiratory tract and symptoms tend to develop more quickly. For industry, inhalation is much more important than is ingestion.

Modified Material Safety Data Sheet (cont'd)
Lead (Pb)

Section VII - Precautions for Safe Handling and Use
(steps to take in case material is spilled or released)(waste disposal method)(precautions to be takin in handling and storage) Rubber gloves containing lead may ignite in nitric acid.

Section VIII - Control Measures
(respiratory protection)(ventilation - local, mechanical, special)(protective gloves)(eye protection)(other protective clothing or equipment)(work/hygenic practices)
See 29 CFR 1910.1025 for addition occupation requirements when working with lead.

OSHA PEL: TWA 0.2 mg/m^3
NIOSH REL: (To Coal Tar Products) TWA 0.1 mg/m^3

DOT Classification: Flammable or Combustible; Label Flammable Liquid

THR: An experimental carcinogen and tumorigen. Mutagenic data. A human and experimental skin irritant. When heated to decomposition it emits acrid smoke and irritating fumes.

LCC000 *HR: 1*
LAVENDER ABSOLUTE
CAS: 8000-28-0 NIOSH: OF 6100000

PROP: Found in the flowers of *Lavandula officinalis chaix.* The main constituent is linalyl acetate. A dark green liquid prepared from alcoholic extract of a residue which is extracted from plant material using an organic solvent.

TOXICITY DATA:	CODEN:
skn-rbt 500 mg 24H MLD	FCTXAV 14,449,76
orl-rat LD50:4250 mg/kg	FCTXAV 14,449,76

THR: Mildly toxic by ingestion. A skin irritant. When heated to decomposition it emits acrid smoke and irritating fumes. See also 3,7-DIMETHYL-1,6-OCTADIEN-3-OL ACETATE.

LCD000 *HR: 1*
LAVENDER OIL
CAS: 8000-28-0 NIOSH: OF 6110000

PROP: Main constituent is linalyl acetate. Found in the plant *Lavandulaofficinalif choix (Fam. Labiate).* Prepared by steam distillation of the flowering stalks of the plant.

SYNS:
LAVENDEL OEL (GERMAN) OIL OF LAVENDER

TOXICITY DATA:	CODEN:
skn-rbt 500 mg 24H MLD	FCTXAV 14,451,76
orl-rat LD50:9040 mg/kg	PHARAT 14,435,59

Reported in EPA TSCA Inventory.

THR: Mildly toxic by ingestion. A skin irritant. When heated to decomposition it emits acrid smoke and irritating fumes. See also 3,7-DIMETHYL-1,6-OCTADIEN-3-OL ACETATE.

LCE000 *HR: 3*
LD-813
CAS: 64083-05-2 NIOSH: OF 6730000

PROP: Commercial mixture of aromatic amines containing approx 40% MOCA.

TOXICITY DATA:	CODEN:
orl-rat TDLo:37 g/kg/2Y-C:CAR	TXAPA9 31,159,75

THR: An experimental carcinogen. When heated to decomposition it emits toxic fumes of NO_x. See also AROMATIC AMINES.

LCF000 *HR: 3*
LEAD
CAS: 7439-92-1 NIOSH: OF 7525000
af: Pb aw: 207.19

PROP: Bluish-gray, soft metal. Mp: 327.43°, bp: 1740°, d: 11.34 @ 20°/4°, vap press: 1 mm @ 973°.

SYNS:

C.I. 77575	OLOW (POLISH)
C.I. PIGMENT METAL 4	OMAHA
GLOVER	OMAHA & GRANT
LEAD FLAKE	S1
LEAD S2	SO

TOXICITY DATA:	CODEN:
cyt-hmn-unr 50 µg/m^3	MUREAV 147,301,85
cyt-rat-ihl 23 µg/m^3/16W	GTPZAB 26(10),38,82
cyt-mky-orl 42 mg/kg/30W	TOLED5 8,165,81
orl-rat TDLo:790 mg/kg (MGN):REP	AEHLAU 23,102,71
orl-rat TDLo:1140 mg/kg (14D pre-21D post):REP	PHMCAA 20,201,78
orl-rat TDLo:1100 mg/kg (1-22D preg):TER	FEPRA7 37,895,78
ihl-rat TCLo:10 mg/m^3/24H (1-21D preg):TER	ZHPMAT 165,294,77
orl-wmn TDLo:450 mg/kg/6Y:PNS:CNS	JAMAAP 237,2627,77
ihl-hmn TCLo:10 µg/m^3:GIT:LIV	VRDEA5 (5),107,81
ipr-rat LDLo:1000 mg/kg	EQSSDX 1,1,75
orl-pgn LDLo:160 mg/kg	HBAMAK 4,1289,35

IARC Cancer Review: Animal Inadequate Evidence IMEMDT 23,325,80. Lead and its compounds are on the Community Right To Know List. Reported in EPA TSCA Inventory. EPA Genetic Toxicology Program.

OSHA PEL: TWA 0.05 mg(Pb)/m^3
ACGIH TLV: TWA 0.15 mg(Pb)/m^3
NIOSH REL: TWA (Inorganic Lead) 0.10 mg(Pb)/m^3

THR: Poison by ingestion. Moderately toxic by intraperitoneal route. It is a suspected carcinogen of the lungs and kidneys. Human systemic effects by ingestion and inhalation: loss of appetite, anemia, malaise, insomnia, headache, irritability, muscle and joint pains, tremors, flaccid paralysis without anesthesia, hallucinations and distorted perceptions, muscle weakness, gastritis and liver changes. The major organ systems affected are the nervous system, blood system, and kidneys. Lead encephalopathy is accompanied by severe cerebral edema, increase in cerebral spinal fluid pressure, proliferation and swelling of endothelial cells in capillaries and arterioles, proliferation of glial cells, neuronal degeneration and areas of focal cortical necrosis in fatal cases. Experimental evidence now suggests that blood levels of lead below 10 µg/dl can have the effect of dimin-

ishing the IQ scores of children. Low levels of lead impair neurotransmission and immune system function and may increase systolic blood pressure. Reversible kidney damage can occur from acute exposure. Chronic exposure can lead to irreversible vascular schlerosis, tubular cell atrophy, interstitial fibrosis, and glomerular sclerosis. Severe toxicity can cause sterility, abortion and neonatal mortality and morbidity. An experimental teratogen. Experimental reproductive effects. Human mutagenic data. Very heavy intoxication can sometimes be detected by formation of a dark line on the gum margins, the so-called "lead line."

When lead is ingested, much of it passes through the body unabsorbed, and is eliminated in the feces. The greater portion of the lead that is absorbed is caught by the liver and excreted, in part, in the bile. For this reason, larger amounts of lead are necessary to cause toxic effects by this route, and a longer period of exposure is usually necessary to produce symptoms. On the other hand, upon inhalation, absorption takes place easily from the respiratory tract and symptoms tend to develop more quickly. For industry, inhalation is much more important than is ingestion. For the general population, exposure to lead occurs from inhaled air, dust of various types, and food and water with an approximate 50/50 division between inhalation and ingestion routes. Lead occurs in water in either dissolved or particulate form. At low pH, lead is more easily dissolved. Chemical treatment to soften water increases the solubility of lead. Adults absorb about 5-15% of ingested lead and retain less than 5%. Children absorb about 50% and retain about 30%.

Lead produces a brittleness of the red blood cells so that they hemolyze with but slight trauma: the hemoglobin is not affected. Due to their increased fragility, the red cells are destroyed more rapidly in the body than is normal, producing an anemia which is rarely severe. The loss of circulating red cells stimulates the production of new young cells which, on entering the blood stream, are acted upon by the circulating lead, with resultant coagulation of their basophilic material. These cells after suitable staining, are recognized as "stippled cells." There is no uniformity of opinion regarding the effect of lead on the white blood cells.

In addition to its effect on the red blood cells, lead produces a damaging effect on the organs or tissues with which it comes in contact. No specific or characteristic lesion is produced. Autopsies in deaths attributed to lead poisoning and experimental work on animals have shown pathological lesions of the kidneys, liver, male gonads, nervous system, blood vessels and other tissues. None of these changes, however, has been found consistently. In cases of severe lead poisoning, the amount of lead found in the blood is frequently in excess of 0.07 mg per 100 cc of whole blood. The urinary lead excretion generally exceeds 0.1 mg per liter of urine.

Flammable in the form of dust when exposed to heat or flame. Moderately explosive in the form of dust when exposed to heat or flame. Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Rubber gloves containing lead may ignite in nitric acid. Violent reaction on ignition with chlorine trifluoride; concentrated hydrogen peroxide; ammonium nitrate (below 200°C with powdered lead); sodium acetylide (with powdered lead). Incompatible with NaN_3; Zr; disodium acetylide; oxidants. Can react vigorously with oxidizing materials. A common air contaminant. When heated to decomposition it emits highly toxic fumes of Pb. See also LEAD COMPOUNDS. For further information, see Vol. 1, No. 1 of *DPIM Report*.

LCG000 *HR: 3*

LEAD ACETATE

CAS: 301-04-2 NIOSH: AI 5250000
DOT: 1616
mf: $C_4H_6O_4{\cdot}Pb$ mw: 325.29

PROP: Trihydrate: colorless crystals or white granules or powder. Sltly acetic odor, slowly effloresces. D: 2.55, mp: 75° (when rapidly heated), decomp above 200°. Very sol in glycerol.

SYNS:

ACETATE de PLOMB (FRENCH)
ACETIC ACID LEAD (2+) SALT
BLEIACETAT (GERMAN)
DIBASIC LEAD ACETATE
LEAD (2+) ACETATE
LEAD(II) ACETATE
LEAD DIACETATE
LEAD DIBASIC ACETATE
NORMAL LEAD ACETATE
PLUMBOUS ACETATE
RCRA WASTE NUMBER U144
SALT OF SATURN
SUGAR OF LEAD

TOXICITY DATA:

sln-smc 250 µmol/L
cyt-hmn:lym 1 mmol/L/24H
mnt-rat-ipr 51800 µg/kg
otr-rat:emb 200 mg/L
oms-rat-ipr 10400 µg/kg
cyt-rat-unr 9 mg/kg/26W-C
cyt-rat-ipr 51800 µg/kg
orl-rat TDLo:600 µg/kg (30D male):REP
orl-rat TDLo:1413 mg/kg (1-18D preg):TER
orl-mus TDLo:236 mg/kg (7-16D preg):TER
orl-rat TDLo:900 mg/kg/60D-C:NEO
orl-rat TD :250 g/kg/47W-C:ETA
orl-rat TD :2430 mg/kg/23W-C:ETA
orl-rat TD :4605 mg/kg/44W-C:ETA
orl-rat TD :7560 mg/kg/72W-C:NEO
orl-rat TD :9150 mg/kg/44W-C:NEO
orl-rat TD :218 g/kg/1Y-C:ETA
orl-rat TD :138 g/kg/76W-C:ETA

CODEN:

MUTAEX 1,21,86
TXCYAC 10,67,78
AEHLAU 40,144,85
JJIND8 67,1303,81
AEHLAU 40,144,85
GISAAA 49(3),15,84
AEHLAU 40,144,85
AJOGAH 115,1058,73
ENVRAL 30,152,83
ARTODN 41,125,78
ENVRAL 24,391,81
BJCAAI 16,283,62
ENVRAL 24,391,81
ENVRAL 24,391,81
ENVRAL 24,391,81
AJPAA4 50,571,67
BECTA6 23,464,79
TOPADD 13,50,85

IMEMDT 23,205,80. Lead and its compounds, as well as chromium and its compounds are on the Community Right To Know List. Reported in EPA TSCA Inventory.

OSHA PEL: TWA 0.05 mg(Pb)/m^3; CL 0.1 mg(CrO3)/m^3
ACGIH TLV: TWA 0.05 mg(Cr)/m^3; TWA 0.15 mg(Pb)/m^3
NIOSH REL: (Chromium(VI)) TWA 0.001 mg(Cr(VI))/m^3; (Inorganic Lead) TWA 0.10 mg(Pb)/m^3

THR: A human carcinogen. An experimental carcinogen, neoplastigen and tumorigen. Human mutagenic data. When heated to decomposition it emits very toxic fumes of Pb. See also LEAD COMPOUNDS and CHROMIUM COMPOUNDS.

LCT000 *HR: 3*

LEAD COMPOUNDS

Lead and its compounds are on the Community Right To Know List.

THR: Lead poisoning is one of the commonest of occupational diseases. The presence of lead-bearing materials or lead compounds in an industrial plant does not necessarily result in exposure on the part of the worker. The lead must be in such form, and so distributed, as to gain entrance into the body or tissues of the worker in measurable quantity, otherwise no exposure can be said to exist. Some lead compounds are carcinogens of the lungs and kidneys. Others are experimental neoplastigens and tumorigens.

Mode of entry into body: (1) By inhalation of the dust, fumes, mists or vapors. (Common air contaminants). (2) By ingestion of lead compounds trapped in the upper respiratory tract or introduced into the mouth on food, tobacco, fingers or other objects. (3) Through the skin; this route is of special importance in the case of organic compounds of lead, as lead tetraethyl. In the case of the inorganic forms of lead, this route is of no practical importance. Significant quantities of lead can be ingested from water that has been sitting in pipes with lead solder. Some water coolers may also have this type of solder.

Lead is a cumulative poison. Increasing amounts build up in the body and eventually reach a point where symptoms and disability occur. See LEAD for symptoms of overexposure.

The toxicity of the various lead compounds appears to depend upon several factors: (1) the solubility of the compound in the body fluids; (2) the fineness of the particles of the compound; solubility is greater in proportion to the fineness of the particles; (3) conditions under which the compound is being used. Where a lead compound is used as a powder, contamination of the atmosphere will be much less if the powder is kept damp. Of the various lead compounds, the carbonate, the monoxide, and the sulfate are considered to be more toxic than metallic lead or other lead compounds. Lead arsenate is very toxic due to the presence of the arsenic radical. Organolead compounds are rapidly absorbed by the respiratory and gastrointestinal systems and through the skin. Tetraethyl lead is converted in the body to triethyl lead which is a more severe neurotoxin than inorganic lead. Diagnostic mobilization of lead with calcium EDTA may be useful in questionable cases. When heated to decomposition they emit toxic fumes of Pb. See also LEAD and specific compounds.

LCU000 *HR: 3*

LEAD(II) CYANIDE

CAS: 592-05-2 NIOSH: OG 0175000
DOT: 1620
mf: C_2N_2Pb mw: 259.23

PROP: White powder.

SYNS:
C.I. 77610
C.I. PIGMENT YELLOW 43
CYANURE de PLOMB (FRENCH)
LEAD CYANIDE (DOT)

TOXICITY DATA:
ipr-rat LDLo: 100 mg/kg

CODEN:
NCNSA6 5,27,53

Lead and its compounds, as well as cyanide and its compounds, are on the Community Right To Know List.

OSHA PEL: TWA 0.05 mg(Pb)/m^3
ACGIH TLV: TWA 0.15 mg(Pb)/m^3
NIOSH REL: (Inorganic Lead) TWA 0.10 mg(Pb)/m^3

DOT Classification: Poison B, Label: Poison

THR: Poison by intraperitoneal route. Violent reaction with Mg. A fire hazard and a powerful oxidizer. When heated to decomposition it emits very toxic fumes of Pb, CN^- and NO_x. See also LEAD COMPOUNDS and CYANIDES.

LCV000 *HR: 3*

LEAD DICHLORITE

mf: Cl_2O_4Pb mw: 477.00

Lead and its compounds are on the Community Right To Know List.

SYN: LEAD(II) CHLORITE

THR: Explodes when heated to 100°C or on contact with antimony sulfide or sulfur. Violent reaction with carbon, red phosphorus, or sulfur. When heated to decomposition it emits very toxic fumes of Pb and Cl^-. See also LEAD COMPOUNDS and CHLORITES.

LCW000 *HR: 2*

LEAD DIMETHYLDITHOCARBAMATE

CAS: 19010-66-3 NIOSH: OF 8850000
mf: $C_6H_{12}N_2S_4 \cdot Pb$ mw: 447.63

PROP: Solid. Mp: 253°, d: 2.5.

Appendix F

Carbon Monoxide
MSDS and Reference Information

Modified Material Safety Data Sheet
Carbon Monoxide (CO)

Section I
(manufacturer's name and address)(emergency telephone numbers)(person prepared and date)

Section II - Hazardous Ingredients/Identity Information
(specific chemical name)(OSHA PEL)(ACGIH TLV)(other limits)(%)
Carbon Monoxide 35 ppm 50 ppm 200 ppm STEL

Section III - Physical/Chemical Characteristics
(boiling point -191.3°F)(specific gravity)(vapor pressure)(melting point -207°F)
(vapor density)(evaporation rate)(solubility in water)(appearance and odor: colorless, odorless)
A common air contaminant. Product of combustion/oxidation.

Section IV - Fire and Explosion Hazard Data
(flash point)(flammable limits, lel: 12.5%, uel: 74.2%)(autoign temp: 1128°F)
A dangerous fire hazard when exposed to flame. Severe explosion hazard when exposed to heat or flame.
(extinguishing media)(special fire fighting procedures) To fight fire, stop flow of gas.

Section V -Reactivity Data
(stability)(conditions to avoid) Violent or explosive reaction on contact with bromine trifluoride; bromine pentafluoride; chlorine dioxide; peroxodisulfuryl difluoride. Mixture of liquid CO with liquid oxygen is explosive. Reacts with sodium or potassium to form explosive products sensitive to shock, heat, or contact with water.
(incompatibility)(hazardous decomposition)(hazardous polymerization)(conditions to avoid)

Section VI - Health Hazard Data
(routes of entry - inhalation, skin, ingestion)(acute)(chronic) Can cause asphyxiations by preventing hemoglobin from binding oxygen. After being removed from exposure, the half-life of its elimination from the blood is one hour. Repeated exposure to low concentrations of the gas, up to 100 ppm in air, is generally believed to cause no signs of poisoning or permanent damage.
(carcinogenicity)(signs and symptoms or exposure)(medical conditions)(emergency and first aid procedures)

Section VII - Precautions for Safe Handling and Use
(steps to take in case material is spilled or released)(waste disposal method)
(precautions to be takin in handling and storage)

Section VIII - Control Measures
(respiratory protection)(ventilation - local, mechanical, special)(protective gloves)(eye protection)(other protective clothing or equipment)(work/hygenic practices)

CARBON MONOXIDE

CAS: 630-08-0

CO

TLV–TWA, 50 ppm (57 mg/m^3)

TLV–STEL, 400 ppm (458 mg/m^3)

1946–1947: MAC–TWA, 100 ppm
1948–1966: TLV–TWA, 100 ppm
1965: TLV–TWA, 50 ppm, proposed
1967–present: TLV–TWA, 50 ppm
1976–present: TLV–STEL, 400 ppm
1991: TLV–TWA, 25 ppm, proposed
1991: Documentation revised

Chemical and Physical Properties

Carbon monoxide is a flammable, colorless, and odorless gas. Chemical and physical properties include:

Molecular weight: 28.01
Freezing point: –207°C
Condensation point: –190°C
Lower explosive limit: 12.5% by volume in air
Solubility: sparingly soluble in water (2.3 ml/100 ml of water at 20°C

Carbon monoxide has a density practically the same as that of nitrogen, slightly less than that of air.

Major Uses or Sources of Occupational Exposure

Carbon monoxide is mainly encountered as a product of incomplete combustion of almost any carbonaceous material, especially as created by the exhaust of internal combustion engines. Operation of these engines in an enclosed area, without adequate ventilation, is still an important source of occupational exposure. High concentrations are frequently encountered in blast furnace operations in the steel industry. Space heaters, improperly adjusted oil or gas burners, and fires in buildings are also common sources of carbon monoxide exposure.

Human Studies

Background

Carbon monoxide's primary toxic action is the inhibition of cell oxidation following inhalation exposure. Carbon monoxide rapidly diffuses across alveolar, capillary, and placental membranes and is reversibly bound to one of the heme proteins. Approximately 80%–90% of the absorbed carbon monoxide binds with hemoglobin resulting in a reduction in the oxygen-carrying capacity of the blood. The major site of toxicity, however, may involve carbon monoxide binding to cytochrome a_3 oxidase, causing a direct inhibition of mitochondrial respiration.[1] The remainder of the carbon monoxide binds with other heme proteins, e.g., myoglobin, causing depressed cardiac function and muscle oxygenation; the hydroperoxidases, possibly causing cell damage via oxygen radicals; and cytochrome P-450.

A small amount of carbon monoxide is produced endogenously; mainly from the catabolism of hemoglobin. In healthy, unexposed subjects at rest, this results in a carboxyhemoglobin (COHb) saturation of 0.4%–0.7%.[2] The background levels in the general population (approximately 0.5%–1.5%) are higher due to environmental exposure. During pregnancy, increased maternal COHb levels of 0.4%–2.6% have been reported.[3] Similarly, the range of COHb for the fetus of nonsmoking mothers has been reported as 0.7%–2.5%; however, a recent study of 64 newborn infants of smoking and exsmoking mothers found a range of 1.1%–4.3% COHb.[4] Hypermetabolism, certain drugs, and hemolytic anemia can increase the endogenous production of COHb to 4%–6%.[5] Tobacco smokers are the most heavily exposed, nonindustrial segment of the population. COHb levels in this group range from 4% to 20% with a mean for one-pack-per-day consumers of 5%–6%.[6]

The absorption and elimination of carbon monoxide has been mathematically described.[7,8] The most influential variables in determining COHb levels are carbon monoxide concentration, duration of exposure, and alveolar ventilation. For example, the expected blood COHb values for an average-sized adult under conditions of light work for 6–8 hours at 35 ppm carbon monoxide will be approximately 5%. After an exposure of 200 ppm for 15 minutes, an average adult engaged in heavy work or a smaller adult engaged in light work will have a COHb level of approximately 5%.

Cardiovascular Studies

A number of early studies found that increments in COHb of less than 5% resulted in cardiovascular effects in normal volunteers, such as acute reduction in exercise tolerance,[9,10] reductions in arterial and mixed venous oxygen tensions,[11] and a reduction in the length of time to the onset of angina in men with stable angina pectoris.[12] Although these findings have not always been reproduced,[13] two recent studies confirm these findings in patients with coronary artery disease. Elevation of COHb levels from 0.6% to 2% and 3.9% in 63 men caused a decrease in time to myocardial ischemia and angina,[14] and average COHb levels of 2.9% resulted in significantly reduced exercise tolerance with onset of angina.[15] These findings are supported by animal experiments. COHb saturations of 5% result in an increase in myocardial ischemia associated with acute myocardial infarction in dogs.[16]

A crew of workers in the Holland Tunnel worked 2

hours in an average tunnel concentration of 70 ppm carbon monoxide, alternating with 2 hours out of the tunnel, for 8-hour swing shifts. These workers had an average of 5% COHb with no one above 10%. The average exposure was approximately 35 ppm, and no symptoms or adverse health effects were observed.[17] On the other hand, a retrospective study of 1212 tunnel officers exposed to carbon monoxide, resulting in less than 5% COHb, were found to have a significantly elevated risk of dying from arteriosclerotic heart disease.[18]

Two workers with pre-existing coronary artery disease died after exposure to carbon monoxide sufficient to produce approximately 25% COHb. This level could be reached after exposure to approximately 2000 ppm carbon monoxide for 15 minutes of light work.[19]

Neurologic/Psychomotor Studies

It is well known that anoxia produced by carbon monoxide poisoning may produce acute neurological deficits as well as severe, and often delayed, neurological sequelae. Absorption of carbon monoxide sufficient to cause a COHb level above 10% may be noticed by symptoms such as headache. A number of studies report on the effects of low-level carbon monoxide exposure (resulting in 2%–5% COHb) on performance of psychomotor tasks. Decrements in psychomotor function are observed at 3%–4% COHb, although conflicting results have been reported.[20]

One explanation for inconsistent findings is that positive results have usually only been observed when the psychomotor tasks were of long duration.[21] For example, a 3.4% increase in COHb resulted in a highly significant deficit in "careful driving skills,"[22] 2% or 4% COHb was associated with reduced video game performance,[21] and 5% COHb caused decrements in vigilance tests.[23] Other behavioral tests on subjects exposed to carbon monoxide sufficient to produce 5% COHb had minimal effects on motor performance only for difficult "dual-task" tests.[24] A report by Bunnell and Horvath[25] indicates that the minimal effects on cognitive performance at 7% are reliably observed and are exacerberated after physical work.

Reproductive/Developmental Studies — Human and Animal

The body compensates for the hypoxic stress due to carbon monoxide exposure by increasing cardiac output and blood flow to specific organs, e.g., the brain or the heart. This ability to compensate may be overpowered or limited when disease or occupational exposure to other chemicals is encountered. In the case of pregnant workers, oxygen consumption is 15%–25% higher than normal; however, the mother's blood oxygen capacity may be decreased 20%–30% because of lowered hemoglobin levels,[26] and endogenous production of carbon monoxide is elevated threefold.[3] The fetus is unable to increase cardiac output in response to carbon monoxide exposure above endogenous levels and is normally close to the critical level for tissue oxygenation.

While the COHb levels of the fetus lag behind changes in maternal COHb, at steady-state, fetal COHb levels are 10%–15% higher than maternal levels, partly because fetal hemoglobin has a higher affinity for carbon monoxide. For example, continuous exposure to 30 ppm carbon monoxide, resulting in approximately 5% COHb in the mother, will produce 6% in the fetus.[3]

Decreased birth weights and fetal death or damage have been reported at moderate exposures to carbon monoxide in test animals.[3] The percentage of successful pregnancies in a control group of rats was 100%; however, a success rate of only 69% was seen in rats treated with 30 ppm carbon monoxide resulting in 4.8% COHb, and 38% was seen in rats treated with 90 ppm carbon monoxide. These effects appear to have been due to implantation problems.[27] Mice exposed at 65 ppm and higher concentrations of carbon monoxide demonstrated dose-dependent effects on the fetus (such as decreased fetal weights and increased fetal mortality) but no signs of maternal toxicity.[28] The offspring of rats exposed at 150 ppm carbon monoxide were also found to have minor reductions in birth weight, but more significantly, persistent memory deficits were identified in juveniles that become more pronounced in adulthood.[29]

A well-established and probably causal relation exists between maternal smoking (resulting in COHb levels of 2%–7% in the fetus) and low birth weight.[3] There also appears to be a dose-related increase in perinatal deaths with maternal smoking. There may also be a retardation of mental abilities in infants born to smoking mothers.[20] Carbon monoxide is likely to be one of the primary etiological agents responsible for these effects.

TLV Recommendation

The present TLV–TWA is 50 ppm, with a STEL of 400 ppm, and was recommended to maintain blood COHb levels of workers at or below 10%. It is recognized that the TLV of 50 ppm might be too high under conditions of heavy labor, high temperature, or at high elevations (over 5000 feet above sea level). Accordingly, a TLV–TWA of 25 ppm was proposed and placed on the Notice of Intended Changes in 1991. The proposed value is intended to keep blood COHb levels below 3.5%, prevent adverse neurobehavioral changes, and maintain cardiovascular exercise capacity. This recommendation will also provide a greater margin of safety for individuals particularly susceptible to the adverse effects of carbon monoxide exposure, including pregnant workers (i.e., the fetus) and those with chronic heart and respiratory disease. Workers who smoke frequently have COHb saturations above 3.5%. Accordingly, exogenous carbon

Table 1. Carbon Monoxide Exposure Duration (minutes) to Reach 3.5% COHb

Carbon Monoxide Concentration (ppm)	Work Load* (time in minutes)		
	Sedentary	Light	Moderate
50	191	102	87
75	117	62	53
100	86	46	39
150	58	31	27
200	46	24	21
300	34	18	15
500	24	13	11
1000	18	10	8

*Work load is defined in terms of alveolar ventilation as follows:

Work Load	Ventilation (L/min)
Sedentary	6
Light	15
Moderate	20

monoxide exposures place them at additional risk of adverse health effects. Pregnant workers and their unborn children may also be at additional risk under conditions of heavy labor, high temperatures, or at high elevations (over 5000 feet above sea level).[30] As noted in the documentation for methylene chloride, that substance is metabolized in the body to carbon monoxide. Concomitant exposures to both methylene chloride and carbon monoxide cause an additive elevation of COHb. Accordingly, the additive formula should be used to evaluate exposures.

Table 1 shows approximate times, calculated from the equation by Coburn et al.,[7] at various exposures to reach a COHb level of 3.5% where there are no other carbon monoxide exposures during the work day.

Along with the reduction in the TLV–TWA, no STEL is proposed because toxicological data and industrial hygiene experience are not available to provide a basis for quantifying on a toxicological basis what the STEL should be. The reader is encouraged to review the section on *Excursion Limits* in the "Introduction to the Chemical Substances" of the current TLV/BEI Booklet for guidance and control of excursions above the TLV–TWA, even when the 8-hour TWA is within the recommended limits. Carbon monoxide is a substance for which Biological Exposure Indices (BEI) have been recommended (see BEI Documentation).

Other Recommendations

OSHA PEL: The OSHA PEL–TWA for carbon monoxide is 35 ppm with a ceiling of 200 ppm to ensure that exposed workers' COHb levels are maintained at or below 5% in order to protect those workers at greater risk because of cardiovascular or pulmonary impairment. In addition, these limits will protect healthy workers who must work in environments involving exertion, heat stress, or other strenuous conditions.[31]

NIOSH REL/IDLH: In the 1972 NICSH criteria document on carbon monoxide,[32] NICSH established a REL–TWA of 35 ppm and a ceiling limit of 200 ppm. NIOSH concurred with the OSHA PEL [NIOSH, Ex 8-47, Table N1].[31] NIOSH established an IDLH value of 1500 ppm for this substance.

ACGIH Rationale for TLVs that Differ from the PEL or REL: The present TLV–TWA of 50 ppm and STEL of 400 ppm are higher than the PEL or REL; however, the TLV of 25 ppm has been proposed to retain blood COHb levels below 3.5%, to prevent adverse neurobehavioral changes, and to maintain cardiovascular exercise capacity. Recent data[18,21–23,27] indicate that COHb levels as high as the 5% level identified for the OSHA PELs and NIOSH RELs places workers with cardiovascular and respiratory disease, those who are pregnant, or those with the need to perform psychomotor tasks at higher risk of adverse effects.

NTP Studies: NTP has not conducted genetic toxicology or long-term toxicology and carcinogenesis effects studies on carbon monoxide.

Other Nations

Australia: 50 ppm TWA, 400 ppm STEL, substance under review (1990); Federal Republic of Germany: 30 ppm, short-term level 60 ppm, 30 minutes, 4 times per shift, Pregnancy Group B, risk of damage to developing embryo or fetus probable even when MAK or Biological Tolerance Values adhered to (1990); Sweden: 35 ppm, short-term value 100 ppm, 15 minutes (1984); United Kingdom: 50 ppm, 10-minute STEL 300 ppm (1991).

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2-(1-METHYL-2-PROPYL)-4,6-DINITROPHENYL ISOPROPYLCARBONATE	TALAN
SYTASOL	UC 19786
	UNION CARBIDE 19786

TOXICITY DATA:	CODEN:
cyt-mus-unr 25 mg/kg	TGANAK 14(6),41,80
cyt-mus-orl 25 mg/kg	CYGEDX 14(6),38,80
orl-rat LD50:59 mg/kg	TXAPA9 14,515,69
ihl-rat LCLo:4850 µg/m³/4H	85GYAZ -,72,71
skn-rat LDLo:1500 mg/kg	TXAPA9 14,515,69
unk-rat LD50:140 mg/kg	30ZDA9 -,100,71
orl-mus LD50:170 mg/kg	GTPZAB 19(9),55,75
ipr-mus LD50:125 mg/kg	BCPCA6 18,1389,69
unk-mus LD50:2540 mg/kg	30ZDA9 -,100,71
skn-rbt LD50:3200 mg/kg	FMCHA2 -,C82,83
orl-ckn LD50:150 mg/kg	GUCHAZ 6,224,73

THR: Poison by ingestion, inhalation, intraperitoneal and possibly other routes. Moderately toxic by skin contact. Mutagenic data. A miticide. See also ESTERS. When heated to decomposition it emits toxic fumes of NO_x.

CBW500 *HR: 1*

CARBONIC ACID CYCLIC PROPYLENE ESTER

CAS: 108-32-7 NIOSH: FF 9650000

mf: $C_4H_6O_3$ mw: 102.10

PROP: A clear liquid. Bp: 242.1°, fp: −48.8°, flash p: 275°F (OC). d: 1.2069 @ 20°/20°, vap press: 0.03 mm @ 20°.

SYNS:

CYCLIC METHYLETHYLENE CARBONATE	1,2-PROPANEDIOL CARBONATE
CYCLIC PROPYLENE CARBONATE	1,2-PROPANEDIOL CYCLIC CARBONATE
CYCLIC-1,2-PROPYLENE CARBONATE	1,2-PROPANEDIYL CARBONATE
1-METHYLETHYLENE CARBONATE	1,2-PROPYLENE CARBONATE
	PROPYLENE GLYCOL CYCLIC CARBONATE

TOXICITY DATA:	CODEN:
skn-hmn 100 mg/3D-I MOD	85DKA8 -,127,77
eye-rbt 60 mg MOD	UCDS** 4/25/58
orl-rat LD50:29 g/kg	UCDS** 4/25/58

Reported in EPA TSCA Inventory.

THR: Mildly toxic by ingestion. A human skin irritant. An eye irritant. See also ESTERS. Combustible when exposed to heat or flame. To fight fire, use alcohol foam. Can react with oxidizing materials. When heated to decomposition it emits acrid smoke and irritating fumes. See also ESTERS.

CBW750 *HR: 3*

CARBON MONOXIDE

CAS: 630-08-0 NIOSH: FG 3500000

DOT: 1016/9202

mf: CO mw: 28.01

PROP: Colorless, odorless gas. Mp: −207°, bp: −191.3°, lel: 12.5%, uel: 74.2%, d: (gas) 1.250 g/L @ 0°, (liq) 0.793, autoign temp: 1128°F.

SYNS:

CARBONE (OXYDE DE) (FRENCH)	FLUE GAS
CARBONIC OXIDE	KOHLENMONOXID (GERMAN)
CARBONIO (OSSIDO DI) (ITALIAN)	KOHLENOXYD (GERMAN)
CARBON MONOXIDE, CRYOGENIC LIQUID (DOT)	KOOLMONOXYDE (DUTCH)
CARBON OXIDE (CO)	OXYDE de CARBONE (FRENCH)
EXHAUST GAS	WEGLA TLENEK (POLISH)

TOXICITY DATA:	CODEN:
ihl-rat TDLo:150 ppm/24H (1-22D preg):TER	TXAPA9 56,370,80
ihl-rat TCLo:150 ppm/24H (1-22D preg):REP	NETOD7 2,7,80
ihl-rat TCLo:1 mg/m³/24H (72D pre):REP	HYSAAV 35(4-6),-277,70
ihl-mus TDLo:65 ppm/24H (7-18D preg):REP	TJADAB 29(2),8B,84
ihl-mus TCLo:250 ppm/7H (6-15D preg):TER	TJADAB 19,385,79
ihl-mus TDLo:125 ppm/24H (7-18D preg):TER	TJADAB 30,253,84
ihl-mus TCLo:8 pph/1H (8D preg):TER	FPNJAG 11,301,58
ihl-rbt TCLo:180 ppm/24H (1-30D preg):REP	LANCAO 2,1220,72
ihl-man LCLo:4000 ppm/30M	29ZWAE -,207,68
ihl-man TCLo:650 ppm/45M:CNS,BLD	AIHAAP 34,212,73
ihl-hmn LCLo:5000 ppm/5M	TABIA2 3,231,33
ihl-rat LC50:1807 ppm/4H	TXAPA9 17,752,70
ihl-mus LC50:2444 ppm/4H	TXAPA9 17,752,70
ihl-dog LCLo:4000 ppm/46M	HBAMAK 4,1360,35
ihl-rbt LCLo:4000 ppm	HBAMAK 4,1360,35
ihl-gpg LC50:5718 ppm/4H	TXAPA9 17,752,70
ihl-mam LCLo:5000 ppm/5M	AEPPAE 138,65,28
ihl-bwd LD50:1334 ppm	AECTCV 12,355,83

Reported in EPA TSCA Inventory.

OSHA PEL: TWA 50 ppm

ACGIH TLV: TWA 50 ppm; STEL 400 ppm; BEI *carboxyhemoglobin in blood less than 8% (*CO in end-exhaled air less than 40 ppm)

DFG MAK: 30 ppm (33 mg/m³); BAT blood 5%

NIOSH REL: TWA 35 ppm; CL 200 ppm

DOT Classification: Flammable Gas, Label: Flammable Gas; Flammable Gas; Label: Flammable Gas and Poison Gas

THR: Mildly toxic by inhalation in humans. An experimental teratogen. Other experimental reproductive effects. Human systemic effects by inhalation: changes in psychophysiological tests and methemoglobinemia-carboxhemoglobinemia. Can cause asphyxiations by preventing hemoglobin from binding oxygen. After being removed from exposure, the half-life of its elimination from the blood is one hour. Chronic exposure effects can occur at lower concentrations. A common air contaminant. Acute cases of poisoning resulting from brief exposures to high concentrations seldom result in any permanent disability if recovery takes place. Chronic effects as the result of repeated

exposure to lower concentrations have been described, particularly in the Scandinavian literature. Auditory disturbances and contraction of the visual fields have been demonstrated. Glycosuria does occur, and heart irregularities have been reported. Other workers have found that where the poisoning has been relatively long and severe, cerebral congestion and edema may occur, resulting in long-lasting mental or nervous damage. Repeated exposure to low concentration of the gas, up to 100 ppm in air, is generally believed to cause no signs of poisoning or permanent damage. Industrially, sequelae are rare, as exposure, though often severe, is usually brief. It is a common air contaminant.

A dangerous fire hazard when exposed to flame. Severe explosion hazard when exposed to heat or flame. Violent or explosive reaction on contact with bromine trifluoride; bromine pentafluoride; chlorine dioxide; peroxodisulfuryl difluoride. Mixture of liquid CO with liquid O_2 is explosive. Reacts with sodium or potassium to form explosive products sensitive to shock, heat, or contact with water. Mixture with copper powder + copper(II) perchlorate + water forms an explosive complex. Mixture of liquid CO with liquid dinitrogen oxide is a rocket propellent combination. Ignites on warming with iodine heptafluoride. Ignites on contact with cesium oxide + water. Potentially explosive reaction with iron(III) oxide between 0-150°C. Exothermic reaction with ClF_3; (Li + H_2O); NF_3; OF_2; (K + O_2); Ag_2O; (Na + NH_3). To fight fire, stop flow of gas. For further information, see Vol. 3, No. 5 of *DPIM Report*.

CBX109 *HR: 3*

CARBONOCHLORIDIC ACID PHENYL ESTER

CAS: 1885-14-9 NIOSH: FG 3850000
DOT: 2746
mf: $C_7H_5ClO_2$ mw: 156.57

SYNS:
CHLOROFORMIC ACID PHENYL ESTER
FENYLESTER KYSELINY CHLORMRAVENCI (CZECH)
PHENYL CHLOROCARBONATE
PHENYL CHLOROFORMATE
PHENYLCHLOROFORMATE (DOT)

TOXICITY DATA:	CODEN:
skn-rbt 500 mg/24H MLD	28ZPAK -,163,72
eye-rbt 50 µg 24H SEV	28ZPAK -,163,72
orl-rat LD50:1410 mg/kg	AIHAAP 30,470,69
ihl-rat LCLo:44 ppm/4H	AIHAAP 30,470,69
skn-rbt LD50:3970 mg/kg	AIHAAP 30,470,69

Reported in EPA TSCA Inventory.

DOT Classification: Poison B; Label: Corrosive and Poison

THR: Poison by inhalation. Moderately toxic by ingestion and skin contact. A corrosive skin and eye irritant. See also ESTERS. When heated to decomposition it emits toxic fumes of Cl^-.

CBX250 *HR: 2*

CARBON REMOVER (LIQUID)

NIOSH: FG 4400000

DOT: 1132

PROP: Flash p: <80°F.

DOT Classification: Flammable Liquid, Label: Flammable Liquid

THR: No toxicity data. Dangerous fire hazard when exposed to heat or flame; can react with oxidizing materials. To fight fire, use CO_2, dry chemical.

CBX750 *HR: 3*

CARBON TETRABROMIDE

CAS: 558-13-4 NIOSH: FG 4725000
DOT: 2516
mf: CBr_4 mw: 331.65

PROP: Colorless, monoclinic tablets. Mp: (α) 48.4°, (β) 90.1°, bp: 189.5°, d: 3.42, vap press: 40 mm @ 96.3°.

SYNS:
CARBON BROMIDE
TETRABROMIDE METHANE
TETRABROMOMETHANE

TOXICITY DATA:	CODEN:
orl-rat LDLo:1000 mg/kg	14CYAT 2,1270,63
scu-mus LD50:298 mg/kg	TXAPA9 4,354,62
ivn-mus LD50:56 mg/kg	CSLNX* NX#01612

Reported in EPA TSCA Inventory.

ACGIH TLV: TWA 0.1 ppm; STEL 0.3 ppm

DOT Classification: Poison B; Label: St. Andrews Cross

THR: Poison by subcutaneous and intravenous routes. Moderately toxic by ingestion. Narcotic in high concentration. Mixture with Li particles is an impact-sensitive explosive. Explodes on contact with hexacylcohexyldilead. When heated to decomposition it emits toxic fumes of Br^-. See also CHLORINATED HYDROCARBONS, ALIPHATIC.

CBY000 *HR: 3*

CARBON TETRACHLORIDE

CAS: 56-23-5 NIOSH: FG 4900000
DOT: 1846
mf: CCl_4 mw: 153.81

PROP: Colorless liquid; heavy, ethereal odor. Mp: −22.6°, bp: 76.8°, fp: −22.9°, flash p: none, d: 1.597 @ 20°, vap press: 100 mm @ 23.0°.

SYNS:
BENZINOFORM
CARBONA
CARBON CHLORIDE
CARBON TET
CZTEROCHLOREK WEGLA (POLISH)
ENT 4,705
FASCIOLIN
FLUKOIDS
METHANE TETRACHLORIDE
NECATORINA
NECATORINE
PERCHLOROMETHANE
R 10

Appendix G

Welding Fumes
Reference Information

WAT325 *HR: 3*
WATER HEMLOCK

PROP: The various species of Cicuta may grow only to 6 feet with compound leaves, with small, whitish, strongly scented flowers, tuberous roots, and an oily yellow sap that smells of parsnip. They are found throughout North America but only in wet, marshy soil.

SYNS:
BEAVER POISON
CHILDREN'S BANE
CICUTA BULBIFERA L.
CICUTA DOUGLASII
CICUTA MACULATA
CICUTAIRE (CANADA)
DEATH-OF-MAN
MUSQUASH POISON
MUSQUASH ROOT
SPOTTED COWBANE

THR: The whole plant contains the poison cicutoxin. Human systemic effects by ingestion occur within 1 hour and include: nausea, salivation, vomiting, muscle spasms in the jaw, convulsions, and death. Survivors may experience prolonged mental deficits and abnormal electroencephalograms. See also CICUTOXIN.

WAT350 *HR: D*
WATER-PEPPER HERB

NIOSH: TQ 9299000

SYN: POLYGONUM HYDROPIPER L., dry powdered whole plant

TOXICITY DATA:	CODEN:
orl-mus TDLo: 840 g/kg (21D pre): REP	JOENAK 12,252,55
orl-gpg TDLo: 1008 g/kg (56W pre): REP	JOENAK 12,252,55

THR: Experimental reproductive effects.

WBA000 *HR: 3*
WAX MYRTLE

NIOSH: ZC 0320000

PROP: Tannin containing fraction of bark used (JNCIAM 57,207,76).

SYNS:
MYRICA CERIFERA
SOUTHERN BAYBERRY
SWEET MYRTLE
TANNIN FROM WAX MYRTLE

TOXICITY DATA:	CODEN:
scu-rat TDLo: 560 mg/kg/69W-I: NEO	JNCIAM 57,207,76

THR: An experimental neoplastigen. See also TANNIC ACID.

WBA600 *HR: 2*
WD 67/2
CAS: 49561-54-8 NIOSH: RO 0810900
mf: $C_{19}H_{21}N_3O \cdot ClH$ mw: 343.89

SYN: 4-(2-(α-METHYLPHENETHYLAMINO)ETHYL)-3-PHENYL-1,2,4-OXADIAZOLE MONOHYDROCHLORIDE

TOXICITY DATA:	CODEN:
orl-rat LD50: 649 mg/kg	BCFAAI 112,273,73
orl-mus LD50: 1455 mg/kg	BCFAAI 112,273,73
scu-mus LD50: 3315 mg/kg	BCFAAI 112,273,73

THR: Moderately toxic by ingestion and subcutaneous routes. When heated to decomposition it emits toxic fumes of NO_x and HCl.

WBJ000 *HR: 3*
WELDING FUMES

ACGIH TLV: TWA 5 mg/m^3

THR: When welding is done on a surface coated with cadmium, toxic fumes of cadmium are evolved. When zinc-coated surfaces are welded, toxic quantities of zinc oxide may be liberated. When painted surfaces are welded, lead or other pigment fumes may be liberated. And when fluoride fluxes are used in welding, very toxic fluoride fumes are evolved. When oily surfaces are welded, offensive and toxic fumes can be liberated, and when the welding torch is improperly ignited, carbon monoxide, which is very toxic, may be evolved. Also, NO_x is formed. It is therefore considered hazardous to inhale excessive amounts of welding fumes. It is also possible to inhale sufficient quantities of iron oxide from welding to cause siderosis. Metal fume fever is a common reaction. It is characterized by chills, fever, sweating, and leukocytosis coming on several hours after exposure. Recovery is usually complete in 24-48 hours and there are no significant after effects. Safety goggles are required to protect against spatter. Light-filtering goggles are required to shield the eyes against the intense UV light from the arc. See also specific metals or their compounds (e.g., CADMIUM and CADMIUM COMPOUNDS).

WBJ500 *HR: 3*
WELLBATRIN
CAS: 31677-93-7 NIOSH: UG 8858000
mf: $C_{13}H_{18}ClNO \cdot ClH$ mw: 276.23

SYNS:
BUPROPION HYDROCHLORIDE
(±)-α-(tert-BUTYLAMINO)-3-CHLOROPROPIOPHENONE HYDROCHLORIDE
(±)-1-(3-CHLOROPHENYL)-2-((1,1-DIMETHYLETHYL)AMINO)1-PROPANONE HYDROCHLORIDE (9CI)

TOXICITY DATA:	CODEN:
orl-rat LD50: 600 mg/kg	JPPMAB 29,767,77
ipr-rat LD50: 210 mg/kg	JPPMAB 29,767,77
orl-mus LD50: 575 mg/kg	JPPMAB 29,767,77
ipr-mus LD50: 230 mg/kg	JPPMAB 29,767,77

THR: Poison by intraperitoneal route. Moderately toxic by ingestion. When heated to decomposition it emits toxic fumes of NO_x and Cl^-.

WELDING FUMES, Not Otherwise Classified

TLV–TWA, 5 mg/m^3

1974–present: TLV–TWA, 5 mg/m^3, "Substances of variable composition" Appendix

1992: Documentation revised

Major Uses or Sources of Occupational Exposure

This TLV refers only to manual metal arc or oxy-acetylene welding of iron, mild steel, or aluminum. In electric or oxy-gas welding of iron sheet, galvanized iron, or aluminum, the chief components of the fume are ordinarily oxides of iron, zinc, or aluminum. Other fumes,[1] as well as toxic gases,[2–5] may be present in significant amounts, however. Manganese, silicate, and organic binders are commonly present in the coatings of welding rods for ferrous metals; fluoride in those for aluminum. Elements such as arsenic and copper are sometimes found. Many aluminum rods contain appreciable quantities of silicon and some have traces of beryllium. In shielded arc welding, ozone is often formed, and carbon monoxide has been reported when carbon dioxide was utilized as a shield gas.[6–7]

In welding mild steel, the fume may consist of metallic oxides from the metal being welded and from the rod itself and its coating. Numerous other substances are frequently present. These may include as many as 18 different substances contributed by the fluxes including manganese, silica, titanium, fluoride, and silicates of sodium and potassium. In a study of the effects of welding fume in the rat, Hewitt and Hicks,[8] using a rutile iron rod with a coating containing limestone, manganese dioxide, kaolin, and cellulose powder bound by sodium and potassium silicates, found that the welding fume contained decomposition products of both the welding rod and the work piece and some of the elements of the rod coating.

In one study of welding fume conducted by Michigan's Environmental and Occupational Health Services Administration,[9] only an average of 47.76% of the fume was found to be iron oxide. Welding types considered were manual metal arc, semi-automatic, carbon dioxide wire welding, metal inert gas (MIG), and butt. The balance of the fume was considered to be contributed by the rod coatings and other metal oxides, such as copper on coated MIG wire.

Studies conducted by three different investigators have indicated that there is a marked difference in the concentration of contaminants when simultaneous samples are obtained inside and outside the welding helmet. Johnson[10] concluded that samples taken outside the helmet were considerably higher than those within. Alpaugh et al.,[11] in their studies, made the following conclusions: 1) concentrations of particulate, e.g., iron oxide, outside the helmet were excessive and erratic and 2) measurements within the helmet were quite low and considerably less variable; concentrations of nitrogen dioxide also were less under the helmet. In respect to ozone they concluded that the helmet offered enough protection to significantly reduce concentrations compared with those taken outside the helmet. Van Sandt and Sharenbroch[12] describe a modified welding helmet for sampling fume and gases such as carbon monoxide, nitrogen dioxide, and ozone. A modified helmet for inside sampling has also been described by Johnson.[10] Relatively recent investigations of welding fume have been conducted by sampling within the conventional welding helmet.[1,13,14] Results from the Goller and Paik study[14] indicate that iron oxide fume concentrations at the breathing zone inside the helmets of welders are reduced to 36% to 71% of concentrations outside the helmets, depending on the type of welding and the postures of the welders.

TLV Recommendation

Because of the additional hazard created by toxic gases and small amounts of fumes of elements more toxic than those of iron oxide,[6] a TLV–TWA of 5 mg/m^3 total fume concentration in the breathing zone of the welder or others in the area is recommended when welding iron, mild steel, or aluminum.

In view of the studies which demonstrated that the concentration of contaminants was lower inside the welding helmet,[10–14] it is the intent of the TLV Committee that this exposure limit be applied to samples obtained *inside* the welding helmet. At this time, no STEL is recommended until additional toxicological data and industrial hygiene experience become available to provide a better base for quantifying on a toxicological basis what the STEL should be. The reader is encouraged to review the section on *Excursion Limits* in the "Introduction to the Chemical Substances" of the current TLV/BEI Booklet for guidance and control of excursions above the TLV–TWA, even when the 8-hour TWA is within the recommended limits.

The fumes from stainless steel, cadmium- or lead-coated steel, and other metals such as copper, nickel, and chromium are considerably more toxic and the worker's exposure concentration should generally be kept at a lower level, depending on the TLVs of the specific metal or other constituent involved. In addition, in the shielded-arc welding of reactive metals and alloys such as aluminum and titanium, relatively large amounts of ozone may be generated and the concentration of this gas may largely determine the health hazard.

Other Recommendations

OSHA PEL: OSHA established a PEL–TWA of 5 mg/m^3 for particulates generated during the welding of aluminum, iron, or mild steel, measured as total particu-

late inside the welder's breathing zone. OSHA concluded a PEL was necessary to protect workers involved in the welding of aluminum, iron, or mild steel from the significant risk of metal fume fever and respiratory irritation associated with the generation of welding fumes.[15] The OSHA PEL is consistent with the recommended ACGIH TLV.

NIOSH REL/IDLH: NIOSH established a REL of a reduction of worker exposure to all chemical and physical agents associated with welding to the lowest concentrations technically feasible.[16] NIOSH [Ex 8-47, Table N6B] did not concur with the OSHA PEL for welding fumes. NIOSH recommended that exposures to all welding emissions be reduced to the lowest feasible concentration using state-of-the-art engineering controls and work practices and that OSHA label welding fumes a potential occupational carcinogen.[15] NIOSH has not established an IDLH value for welding fumes.

ACGIH Rationale for TLVs that Differ from the PEL or REL: The ACGIH believes that there is an inadequate toxicologic database on welding emissions from aluminum, iron, or mild steel to identify such fumes as potential occupational carcinogens and that the TLV will protect workers from metal fume fever and respiratory tract irritation.

NTP Studies: NTP has not conducted genetic toxicology, short-term toxicology, or long-term toxicology and carcinogenesis effects studies on welding fumes.

Carcinogenic Classification

NIOSH: Carcinogen, with no further categorization.

Other Nations

Australia: 5 mg/m^3, inside helmet (1990); United Kingdom: 5 mg/m^3 (1991).

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Appendix H

Nitrogen Dioxide
Reference Information

NITROGEN DIOXIDE

CAS: 10102-44-0

NO_2

TLV–TWA, 3 ppm (5.6 mg/m³)

TLV–STEL, 5 ppm (9.4 mg/m³)

1946–1947: MAC–TWA, 25 ppm (Nitrogen oxides other than nitrous oxide)

1948–1953: TLV–TWA, 25 ppm (Nitrogen oxides other than nitrous oxide)

1954–1962: TLV–TWA, 5 ppm

1963–1969: TLV–CEILING, 5 ppm

1970: TLV–TWA, 5 ppm

1971–1980: TLV–CEILING, 5 ppm

1979: TLV–TWA, 3 ppm; TLV–STEL, 5 ppm; proposed

1981–present: TLV–TWA, 3 ppm; TLV–STEL, 5 ppm

1992: Documentation revised

Chemical and Physical Properties

Nitrogen dioxide (NO_2) is a reddish-brown gas, and in high concentrations, it is partially associated to nitrogen tetroxide (N_2O_4). Below its boiling point, it is a colorless liquid. This compound is formed by the action of nitric acid on reducing agents; by the combustion of nitrogenous organic material; and the oxidation of nitric oxide in air or oxygen. High concentrations are frequently present in silos where ensilage is stored; varying amounts result from the detonation of nitro or nitrate explosives. Chemical and physical properties include:[1]

Molecular weight: 46.01
Specific gravity: 1.448 at 20°C (liquid)
Melting point: –9.3°C
Boiling point: 21.15°C
Condensation point: 21°C
Vapor pressure: 720 torr at 20°C
Vapor density: 1.58 (air = 1.0)
Solubility: soluble in concentrated nitric and sulfuric acids; decomposes in water forming nitric oxide and nitric acid

Major Uses or Sources of Occupational Exposure

Nitrogen dioxide finds limited use as a nitrating or oxidizing agent and in rocket fuels. It is an intermediate in the formation of nitric acid. The majority of occupational exposures to NO_2, however, result from its presence as a by-product of nitrate decomposition, as in the reaction of nitric acid with metals or other reducing agents; from various processes in which air is heated to a high temperature, with the formation of nitric oxide; or in the exhaust of internal-combustion engines.

Animal Studies

Acute

In studies reported by Gray et al.,[2,3] rats exposed to the vapor of red fuming nitric acid 4 hours/day, 5 days/week for 8 or more weeks showed lung injury at concentrations averaging in excess of 8 ppm. Similarly, rats exposed daily for 6 months at 4 ppm showed no lung changes attributable to the toxic effects of NO_2. The NO_2 concentrations varied considerably from the mean as indicated from the reported standard deviations. Later consideration of the studies of Gray et al.[2,3] indicated that data on mixed exposures of NO_2 and nitric acid vapor were less applicable to the industrial situation than pure NO_2.

Ripperton and Johnston[4] performed a continuous exposure of young rats at 0.5 ppm NO_2 for 6 weeks. Although blood catalase values were felt to be significantly different from controls, the hygienic significance of these findings is in doubt.

Henry and co-workers[5] reported that monkeys exposed to NO_2 at 10 ppm for 1 month or at 5 ppm for 2 months showed a marked decrease in resistance to infections.

Chronic

Wagner et al.[6] reported that pure NO_2 in 6 hours/day, 5 days/week exposures of dogs, rabbits, guinea pigs, rats, hamsters, and mice at concentrations of 1 ppm (no mice), 5 ppm, or 25 ppm (no dogs or mice) were without chronic effect after 16–18 months.

There have been several studies on the effects of continuous exposure at low concentrations of NO_2 to simulate conditions resulting from air pollution. Freeman and associates[7] found that rats continually exposed at 0.8 ppm NO_2 had elevated respiratory rates but showed no real ill effects, while at 2 ppm, there were slight lung changes, but life-spans were normal.[8] Ehrlich and Henry,[9] however, found that continuous and intermittent exposures of mice at 0.5 ppm resulted in increased mortality. The reason advanced was that there was a decreased capacity to clear viable bacteria from the lung. However, with intermittent exposure, the change was less for the 12-month exposure than in that for 6 months. Blair et al.[10] found that with mice, exposure at 0.5 ppm for 6, 18, or 24 hours daily for 3 to 12 months caused expansion of the alveoli which progressed with exposure. The overall lesions appeared consistent with the development of early focal emphysema.

Human Studies

Many deaths from pulmonary edema, induced by the inhalation of high concentrations of NO_2, have been reported. According to Wade et al.,[11] there were at least 90 deaths prior to 1920 and over 60 between 1930 and

1956. The incidence of chronic effects from long exposures at low concentrations is less well defined.

A Russian report[12] showed reduced blood catalase values in workers who were exposed to oxides of nitrogen that did not vary much above 2.8 ppm during a 3- to 5-year period. The Russian workers, however, reported "probable chronic bronchitis" and emphysema of the lungs from the chronic NO_2 exposure.[12] The exposure may not have been to pure NO_2.

Adley[13] reported that short exposures of workmen to NO_2 concentrations averaging 25 to 38 ppm resulted in no demonstrable physiologic response, but exposures of 3 to 5 minutes at 80 ppm produced tightness of the chest.

Norwood et al.[14] reported a case of pulmonary edema resulting from a 30-minute exposure to an estimated concentration of 90 ppm NO_2, plus fume from metal, in an oxyacetylene cutting process.

Vigliani and Zurlo[15] found no adverse effects in workers exposed several years at 30 to 35 ppm oxides of nitrogen. Patty[16] stated that concentrations of 10 to 20 ppm NO_2 were mildly irritating to the eyes, nose, and upper respiratory tract and that 5 ppm and slightly below had a distinct odor. The odor of NO_2 is perceptible for some individuals at 0.11 ppm; however, for most, it is at 0.22 ppm.[17]

Cooper and Tabershaw,[18] after a review of the biologic effects of NO_2, recommended that the general population should not be exposed more than 1 hour at concentrations in excess of 3 ppm.

A study published in 1972 by Kosmider et al.[19] reported slight changes in vital capacity among workers exposed to NO_2 in concentrations between 0.4 and 2.7 ppm.

TLV Recommendation

On the basis of information from animal and human studies, a TLV–TWA of 3 ppm and a STEL of 5 ppm for NO_2 are recommended. This TLV is considered sufficiently low to reduce the potential for immediate injury or adverse physiologic effects from prolonged daily exposures to NO_2. Industrial data that seem to be at variance with this conclusion are not sufficiently precise to be conclusive.

Other Recommendations

OSHA PEL: The OSHA PEL for NO_2 is a STEL of 1 ppm, averaged over a 15-minute sampling period.[20] OSHA concluded that this limit would protect exposed workers against the significant risk of pulmonary disease, including the risk of increased airway resistance. The OSHA PEL is consistent with the NIOSH REL.

NIOSH REL/IDLH: NIOSH established a REL of 1 ppm for NO_2 as a 15-minute STEL [NIOSH, Ex 8-47, Table N1] by concurrence with the OSHA PEL.[20] NIOSH established an IDLH value of 50 ppm for this substance.

ACGIH Rationale for TLVs that Differ from the PEL and REL: The TLV for NO_2 was based on human studies that indicated normal respiratory function would not be seriously compromised at such exposures. Based on the positions of OSHA, NIOSH, EPA, and the National Academy of Sciences, ACGIH will reexamine its 1981 decision regarding the adequacy of the TLV to protect workers from pulmonary aberrations including reversible increases in airway resistance in normal and compromised workers.

NTP Studies: NTP has not conducted genetic toxicology, other short-term toxicology, or long-term toxicology and carcinogenesis effects studies on nitrogen dioxide.

Other Nations

Australia: TWA 3 ppm, STEL 5 ppm (1990); Federal Republic of Germany: 5 ppm, short-term level 10 ppm, 5 minutes, 8 times per shift (1992); Sweden: 2 ppm, ceiling limit 5 ppm (1991); United Kingdom: 3 ppm, 10-minute STEL 5 ppm (1991).

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NGR000 *HR: 3*
NITROGEN CHLORIDE DIFLUORIDE
mf: ClF_2N mw: 87.46

THR: Very unstable. Use caution in handling.

NGR250 *HR: 3*
NITROGEN (CRYOGENIC LIQUID)
CAS: 7727-37-9 NIOSH: QW 9720000

Reported in EPA TSCA Inventory.

DOT: Nonflammable Gas. Label: Nonflammable Gas

Nitrogen (liquid) can explode during use. See also NITROGEN.

NGR500 *HR: 3*
NITROGEN DIOXIDE
CAS: 10102-44-0 NIOSH: QW 9800000
DOT: 1067
mf: NO_2 mw: 46.01

PROP: Colorless solid to yellow liquid; irritating odor. Mp: −9.3° (yellow liquid), bp: 21° (red-brown gas with decomp), d: 1.491 @ 0°, vap press: 400 mm @ 80°. Liquid below 21.15°. Sol in concentrated sulfuric acid, nitric acid. Corrosive to steel when wet.

SYNS:
AZOTE (FRENCH)
AZOTO (ITALIAN)
NITRITO
NITROGEN PEROXIDE, LIQUID (DOT)
RCRA WASTE NUMBER P078
STICKSTOFFDIOXID (GERMAN)
STIKSTOFDIOXYDE (DUTCH)

TOXICITY DATA:	CODEN:
mmo-sat 6 ppm	MUREAV 136,119,84
cyt-rat-ihl 27 ppm/3H-C	MUREAV 136,119,84
msc-rat-ihl 15 ppm/3H-C	MUREAV 136,119,84
cyt-ham:lng 5 ppm/10M-C	MUREAV 89,303,81
sce-ham:lng 5 ppm/10M-C	MUREAV 89,303,81
ihl-rat TCLo:85 µg/m³ 24H (1-22D preg):TER	GISAAA 42(12),22,77
ihl-rat TCLo:800 µg/m³ 24H (1-22D preg):REP	GISAAA 42(12),22,77
ihl-rat TCLo:10 mg/m³ 5H (1-22D preg):REP	TJADAB 29(3),33A,84
ihl-man TCLo:6200 ppb 10M: PUL	KEKHA7 17,337,68
ihl-man TCLo:90 ppm/40M: PUL	JOCMA7 8,301,66
ihl-hmn LCLo:200 ppm 1M	AOHYA3 17,159,74
ihl-rat LC50:88 ppm/4H	AMIHBC 10,418,54
ihl-mus LC50:1000 ppm 10M	JCTODH 4,246,77
ihl-dog LCLo:123 mg/m³	TXAPA9 9,160,66
ihl-rbt LC50:315 ppm/15M	AIHAAP 23,457,62
ihl-gpg LC50:30 ppm/1H	AEHLAU 10,220,65

Reported in EPA TSCA Inventory. EPA Genetic Toxicology Program.

OSHA PEL: CL 5 ppm
ACGIH TLV: TWA 3 ppm; STEL 5 ppm
DFG MAK: 5 ppm (9 mg/m³)
NIOSH REL: CL (Oxides of Nitrogen) 1 ppm/15M

DOT Classification: Poison A; Label: Poison Gas and Oxidizer

THR: Experimental poison by inhalation. Moderately toxic to humans by inhalation. An experimental teratogen. Human systemic effects by inhalation: pulmonary vascular resistance changes, cough, dyspnea and other pulmonary changes. Experimental reproductive effects. Mutagenic data. Violent reaction with cyclohexane; F_2; formaldehyde and alcohols; nitrobenzene; petroleum; toluene. When heated to decomposition it emits toxic fumes of NO_x. See also NITROGEN MONOXIDE.

NGS000 *HR: 3*
NITROGEN DIOXIDE (LIQUID)
CAS: 10102-44-0 NIOSH: QW 9805000

Reported in EPA TSCA Inventory. EPA Extremely Hazardous Substances List.

DOT Classification: Poison A; Label: Oxidizer and Poison Gas

THR: A poison. See also NITROGEN DIOXIDE, NITROGEN MONOXIDE, and NITRIC OXIDE. For further information, see Vol. 1, No. 5 of *DPIM Report*.

NGS500 *HR: 3*
NITROGEN FLUORIDE OXIDE
CAS: 13847-65-9 NIOSH: QX 0350000
mf: F_3NO mw: 87.01

SYNS:
AMOX
TRIFLUOROAMINE OXIDE

TOXICITY DATA:	CODEN:
ihl-rat LC50:24 ppm/4H	TXAPA9 13,76,68
ipr-rat LD50:38 mg/kg	TXAPA9 13,76,68
ihl-mus LC50:18 ppm/4H	TXAPA9 13,76,68
ipr-mus LD50:30 mg/kg	TXAPA9 13,76,68

OSHA PEL: TWA 2.5 mg(F)/m³
ACGIH TLV: TWA 2.5 mg(F)/m³
NIOSH REL: (Inorganic Fluorides) TWA 2.5 mg(F)/m³

THR: Poison by inhalation and intraperitoneal routes. A skin, eye and mucous membrane irritant. When heated to decomposition it emits very toxic fumes of F^- and NO_x. See also FLUORIDES.

NGT000 *HR: 3*
NITROGEN MONOXIDE
CAS: 10102-43-9 NIOSH: QX 0525000
DOT: 1660
mf: NO mw: 30.01

PROP: Colorless gas, blue liquid and solid. Mp: −161°, bp: −151.18, d: 1.3402 g/L; liquid, 1.269 @ −150°; gas, 1.04.

SYNS:
BIOXYDE D'AZOTE (FRENCH)
NITRIC OXIDE (ACGIH, DOT)
OXYDE NITRIQUE (FRENCH)
RCRA WASTE NUMBER P076
STICKMONOXYD (GERMAN)

TOXICITY DATA:	CODEN:
mmo-sat 30 ppm	MUREAV 136,119,84
msc-rat-ihl 27 ppm/3H-C	MUREAV 136,119,84
msc-ham:lng 10 ppm/10M-C	MUREAV 136,119,84
ihl-rat LC50:1068 mg/m^3	GTPZAB 19(4),52
ihl-mus LCLo:320 ppm	AEPPAE 181,145,36

Reported in EPA TSCA Inventory. EPA Extremely Hazardous Substances List.

OSHA PEL: TWA 25 ppm
ACGIH TLV: TWA 25 ppm
NIOSH REL: (Oxides of Nitrogen) TWA 25 ppm

DOT Classification: Poison A; Label: Poison Gas

THR: A poison gas. A severe eye, skin, and mucous membrane irritant. A systemic irritant by inhalation. Mutagenic data. Exposure may occur whenever nitric acid acts upon organic material, such as wood, sawdust, and refuse; it occurs when nitric acid is heated, and when organic nitro compounds are burned, for example, celluloid, cellulose nitrate (guncotton), and dynamite. The action of nitric acid upon metals, as in metal etching and pickling, also liberates the fumes. In high temperature welding, as with the oxyacetylene or electric torch, the nitrogen and oxygen of the air unite to form oxides of nitrogen. Automobile exhaust and power plant emissions are also sources of NO_x. Exposure occurs in many manufacturing processes when nitric acid is made or used. Oxides of nitrogen have been implicated as a cause of acid rain.

The oxides of nitrogen are somewhat soluble in water reacting with it in the presence of oxygen to form nitric and nitrous acids. This is the action that takes place deep in the respiratory system. The acids formed are irritating and can cause congestion in the throat and bronchi and edema of the lungs. The acids are neutralized by the alkalies present in the tissues with the formation of nitrates and nitrites. The latter may cause some arterial dilation, fall in blood pressure, headache and dizziness, and there may be some formation of methemoglobin. However, the nitrite effect is of secondary importance.

Because of their relatively low solubility in water, the nitrogen oxides are initially only slightly irritating to the mucous membranes of the upper respiratory tract. Their warning power is therefore low, and dangerous amounts of the fumes may be breathed before the worker notices any real discomfort. Higher concentrations (60-150 ppm) cause immediate irritation of the nose and throat with coughing and burning in the throat and chest. These symptoms often clear upon breathing fresh air, and the worker may feel well for several hours. Some 6-24 hours after exposure, a sensation of tightness and burning in the chest develops, followed by shortness of breath, sleeplessness and restlessness. Dyspnea and air hunger may increase rapidly with development of cyanosis and loss of consciousness followed by death. In cases which recover from the pulmonary edema, there is usually no permanent disability, but pneumonia may develop later. Concentrations of 100-150 ppm are dangerous for short exposures of 30-60 minutes. Concentrations of 200-700 ppm may be fatal after even very short exposures.

Continued exposure to low concentrations of the fumes, insufficient to cause pulmonary edema, is said to result in chronic irritation of the respiratory tract with cough, headache, loss of appetite, dyspepsia, corrosion of the teeth and gradual loss of strenth.

Exposure to NO_x is always potentially serious, and persons so exposed should be kept under close observation for at least 48 hours.

An oxidizer. The liquid is a sensitive explosive. Explosive reaction with carbon disulfide (when ignited); methanol (when ignited); pentacarbonyl iron (at 50°C); phosphine + oxygen; sodium diphenylketyl; dichlorine oxide; fluorine; nitrogen trichloride; ozone; perchloryl fluoride (at 100-300°C); vinyl chloride. Reacts to form explosive products with dienes (e.g., 1,3-butadiene, cyclopentadiene, propadiene).

Can react violently with acetic anhydride; Al; amorphous boron; BaO; BCl_3; $CsHC_2$; calcium; carbon + potassium hydrogentartrate; charcoal; ClO; pyrophoric chromium; 1,2-dichloroethane; dichloroethylene; ethylene; fuels; hydrocarbons; hydrogen + oxygen; Na_2O; uns-dimethyl hydrazine; NH_3; $CHCl_3$; Fe; Mg; Mn; CH_2Cl_2; olefins; phosphorus; PNH_2; PH_3; potassium; potassium sulfide; propylene; rubidium acetylide; Na; S; WC; trichloroethylene; 1,1,1-trichloroethane; uns-tetrachloroethane; uranium; uranium dicarbide. Will react with water or steam to produce heat and corrosive fumes; can react vigorously with reducing materials. When heated to decomposition it emits highly toxic fumes of NO_x. For further information, see Vol. 1, No. 5 of *DPIM Report*.

NGT500 *HR: 3*

NITROGEN MONOXIDE, MIXED WITH NITROGEN TETROXIDE

CAS: 63907-41-5 NIOSH: QX 0700000
DOT: 1975

PROP: Containing up to 33.2% by weight nitric oxide (FEREAC 41,15972,76).

SYNS:
AZOTU TLENKI (POLISH)
NITRIC OXIDE AND NITROGEN TETROXIDE MIXTURES (DOT)
NITROGEN TETROXIDE-NITRIC OXIDE MIXTURE (DOT)

TOXICITY DATA:	CODEN:
ihl-rat LC50:115 ppm/1H	AIHAAP 23,457,62

DOT Classification: Poison A; Label: Oxidizer and Poison Gas

Appendix I

Wood Dust
Reference Information

WOOD DUST

Hard wood, as in furniture-making
Soft wood, nonallergenic

TLV–TWA, 1 mg/m^3 — Hard wood
5 mg/m^3 — Soft wood

TLV–STEL, 10 mg/m^3 — Soft wood

1970: TLV–TWA, 5 mg/m^3, nonallergenic; proposed

1972–1980: TLV–TWA, 5 mg/m^3, nonallergenic

1976–1980: TLV–STEL, 10 mg/m^3, nonallergenic

1979: TLV–TWA, 1 mg/m^3, hard wood (as in furniture-making); proposed

1981–present: TLV–TWA, 1 mg/m^3, certain hard woods as beech and oak; TLV–TWA, 5 mg/m^3, and TLV–STEL, 10 mg/m^3, soft wood

1992: Documentation revised

Chemical and Physical Properties

Wood dust is described as any wood particle arising from the processing or handling of wood. Wood consists primarily of cellulose, hemicellulose, and lignin. Wood may also contain a variety of complex organic compounds, including glycosides, quinones, tannins, terpenes, aldehydes, and coumarins.[1] Hard wood trees generally have broadleaves, are deciduous in the temperate regions of the world, and are porous (i.e., contain a vessel element). Hard woods include beech, oak, mahogany, maple, walnut, and others. Soft wood trees are cone bearing, generally have scalelike or needlelike leaves, and are nonporous.[2] Soft woods include fir and pine.

Major Uses or Sources of Occupational Exposure

Exposures to hard wood dusts occur in furniture and cabinet making and exposures to soft wood dusts (nonallergenic dusts) occur among workers in the building (construction), lumber, and sawmill industries. The powdered inner wood from fir trees (wood flour) is used as a filler in putty, linoleum, and plastics. Extensive reviews of the health effects related to occupational exposure to wood dust have been published by the United Kingdom Health and Safety Executive (HSE),[3] the International Agency for Research on Cancer (IARC),[4] the National Institute for Occupational Safety and Health (NIOSH),[5] and the Dutch Expert Committee (DEC) for Occupational Standards.[5] There are numerous reports of occupational dermatitis[6] and asthma[7] resulting from exposure to allergenic dusts (dogwood, mulberry, myrtle, red cedar), and those woods are specifically excluded from consideration here. Only those data utilized in derivation of the TLV for hard wood in furniture-making and nonallergenic soft woods are cited below.

Human Studies

Dermatitis

There are published reports on contact dermatitis for domestic[8] and exotic woods.[9–13]

Respiratory Disease

Reports on respiratory hypersensitivity among woodworkers are prevalent. Ordman[14] reported asthma in a cabinetmaker as the result of inhalation of the dusts of several African woods including kejaat. Suberosis, a form of pneumoconiosis, was manifest as bronchial asthma in cork workers.[15,16] Granulomatous pneumonitis (sequoiosis) was associated with redwood sawdust inhalation.[17] Acute airway obstruction was found in two workers exposed to dust derived from abiruana wood.[18] Several cases of asthma and rhinitis were reported to be due to exposure to cedar[19] and arbor-vitae[20] dusts. Sosman et al.[21] reported the clinical patterns and the laboratory and immunologic features of the reaction to oak dust inhalation.

Carcinogenicity

An increased incidence of adenocarcinoma of the nasal cavity and ethmoid sinus has been demonstrated in woodworkers in the furniture industry of England.[22] Similar reports have come from Belgium,[23] France,[24] and Denmark.[25]

Nasal cancers are rare in the general population, and the published data show quite conclusively that certain workers in the furniture industry are at risk for upper respiratory tract cancer. The trades principally affected are wood machinists, cabinetmakers, and chair workers. The average annual incidence of adenocarcinoma in the Buckinghamshire furniture industry for the decade 1956 to 1965 was 0.7 per 100 or 500 times the expected incidence of this tumor in Englishmen.[22] The average latent period from first exposure until diagnosis of tumor was 39 years in the British cases.[22] The period of exposure was as little as 5 years in workers who left the industry. The average latent period from first exposure until death in four Danish cases was 43 years.[25]

Nasal adenocarcinoma, as an occupational disease, was rare before 1950 in the Oxford area (Table 1).[26] Table 1 shows the total number of cases of adenocarcinoma in men who are known to have been employed at any time in the furniture industry in the Oxford survey to the end of 1974. From a study of England (not including the Oxford study) and Wales, 43 cases of nasal adenocarcinoma were found up to 1969.[27] From the Danish study,[28] 186 cases of nasal cancer were diagnosed over the decade 1965 to 1974; 15 were adenocarcinoma, 12 of which had histories of occupational exposure to wood dust in the furniture industry. Latency ranged from 28 to 57 years.

TABLE 1. Adenocarcinoma Among Furniture Industry Workers, Oxford, England[26]

Year	Number of Cases
Before 1950	3
1950–1954	3
1955–1959	8
1960–1964	12
1965–1969	15
1970–1974	6

From epidemiological data, it was deduced that a factor was present in the British furniture industry between 1920 and 1940 which caused the large number of nasal cancers. No person who entered the industry after 1945 was known to have developed nasal adenocarcinoma up to 1976. The disease, as an occupational risk in the furniture industry, was rare before 1950, and a decline in cases since 1970 has been noted; however, there was also a decline in the number of workers in the industry between 1961 and 1971.[22]

There is sufficient evidence that occupational exposure to wood dust itself, rather than varnishes, polishes, or lacquers applied to the products, is the etiologic agent responsible for the increased risk of nasal adenocarcinoma and carcinoma.[22] The woods in the English furniture industry included oak, beech, mahogany, maple, walnut, and others. One of the French cases[24] involved exposures to oak and teak, and the other was to a variety of hard woods. The four Danish cases involved beech and birch wood.[25] Woodworkers in the building industry, including carpenters and related trades, did not appear to be at risk.[22] It is not clear, however, whether this is because soft woods, rather than hard woods, are commonly used. It is possible that the tasks involved may not produce a sufficiently high concentration of dust of the appropriate particle size to be harmful.

There is no evidence that the conditions which gave rise to the excess risk of nasal cancer exist today. Over the last 40 years, substantial changes in work practice have taken place in exhaust ventilation. The quantity of dust to which the worker can be exposed has been greatly reduced. Unfortunately, no current published workplace air sampling data are available for comparison.

In a Danish study,[23] 68 air samples were taken with personal samplers. The range of results was 0 to 80 mg/m^3; most of the values were below 15 mg/m^3, 15 were less than 5 mg/m^3, and the rest were above 5 mg/m^3. The average dust concentration was 14.3 mg/m^3 at the machine and hand-sanding operations and 5.2 mg/m^3 for drilling, planing, and sawing. The particle size distribution of airborne dust in this study[25] is shown in Table 2. The most frequent complaints by workers were dryness in the nose, eye irritation, nasal obstruction, prolonged colds, and frequent headaches. Workers exposed to wood dust at concentrations greater than 5 mg/m^3 more frequently experienced inflammation of the middle ear and had longer lasting colds. The other symptoms were more prevalent but did not occur significantly more often than those observed in workers with lower exposures.[25]

Impairment of nasal mucociliary clearance has been documented in woodworkers in the furniture industry.[25] The Danish study[25] found that mucostasis increased in direct proportion to the dust concentration: 63% for exposures of 25.5 mg/m^3 and 11% at 2.2 mg/m^3. Mucostasis was usually transient and ciliary tract function returned to normal over a weekend, but there were instances of persistent mucostasis. The Danish study[25] results do not allow conclusions on the mucostatic properties of different woods; however, the authors[28] considered 5 mg/m^3 total dust too high a limit for wood dust in view of the concentration below a TWA of 5 mg/m^3 and the number of mucostatic subjects. It was argued that impaired mucociliary function may be important in the development of nasal adenocarcinoma in furniture workers because of the prolonged retention of wood dust in the nasal cavity.

In its 1987 review of the carcinogenic risks to humans in various wood industries, IARC[4] considered the evidence for carcinogenicity of furniture- and cabinet-making as sufficient and the evidence for exposures during carpentry and joinery as limited.

TLV Recommendation

The principal health effects reported from exposure to wood dust are dermatitis and increased risk of upper respiratory tract disease. Epidemiologic studies of furniture workers have indicated an excess of lung, tongue, pharynx, and nasal cancer. An excess risk of leukemia among millwrights appears to be related to various compounds used in wood preservation. Certain exotic woods (East Indian satinwood, South African boxwood) contain alkaloids that can cause headache, anorexia, nausea, bradycardia, and dyspnea on inhalation.

A TLV–TWA of 5 mg/m^3 and a STEL of 10 mg/m^3 for soft wood (nonallergenic) are recommended because of the apparent low risk for upper respiratory tract involvement among woodworkers in the building industry.[22]

TABLE 2. Particle Size Distribution of Airborne Dust from the Danish Study[28]

Range (μ)	Percent of Particles
< 5	33
6–10	41
11–15	11
16 >	15

Based on the impaired nasal mucociliary function reported[28] to contribute to the development of nasal adenocarcinoma and related hyperplasias in the furniture industry, a separate TLV–TWA of 1 mg/m^3 for hard woods (such as beech, walnut, and oak) is recommended. At this time, no STEL is recommended for hard woods until additional toxicological data and industrial hygiene experience become available to provide a better base for quantifying on a toxicological basis what the STEL should be. The reader is encouraged to review the section on *Excursion Limits* in the "Introduction to the Chemical Substances" of the current TLV/BEI Booklet for guidance and control of excursions above the TLV–TWA, even when the 8-hour TWA is within the recommended limits. The TLVs for hard and soft woods are currently under review by the TLV Committee.

Other Recommendations

OSHA PEL: OSHA established a PEL–TWA of 5 mg/m^3 and a STEL of 10 mg/m^3 for hard and soft wood dust, with the exception of Western red cedar, for which a PEL–TWA of 2.5 mg/m^3 was established. OSHA concluded that promulgation of these exposure limits would substantially reduce the significant risk of material pulmonary dysfunction (including changes in peak flow, interference with mucociliary clearance, respiratory symptoms, and chronic effects) that have been associated with exposure to wood dust at the higher levels permitted in the absence of any promulgated value.[30]

NIOSH REL/IDLH: NIOSH [Ex 8-47, Table N6B] established a REL–TWA of 1 mg/m^3 for hard and soft wood dust as an interim level to be followed by future rulemaking. NIOSH [Ex 8-47, Table N6A] concurred with the originally proposed PEL–TWA of 1 mg/m^3 for hard wood dust. NIOSH [Ex 8-47, Table N6B] did not concur with the OSHA PEL for soft wood dust. NIOSH considered hard and soft wood dust to be potentially carcinogenic in humans [NIOSH CARCINOGEN].[31] NIOSH has not established an IDLH value for these substances.

ACGIH Rationale for TLVs that Differ from the PEL or REL: ACGIH believes that the TLVs should differ for hard and soft woods primarily on the respective data for carcinogenic risk from exposure to the differing types of wood. A TLV of 1 mg/m^3 for hard wood was recommended principally based on prevention of impaired nasal mucociliary function reported to be important in the development of nasal adenocarcinoma in the furniture industry because of the prolonged retention of wood dust in the nasal cavity. The TLV for soft wood is based on the innocuous nature of powdered inner woods of Douglas fir and related species and the low risk of occupational respiratory tract disease among woodworkers in the building industry. The TLVs for hard and soft wood specifically exclude the issue of occupational asthma and related allergic respiratory response associated with exposure to red cedar dust and similar woods; this matter is currently under review by the TLV Committee.

NTP Studies: NTP has not conducted genetic toxicology, other short-term toxicology, or long-term toxicology and carcinogenesis bioassays on hard or soft wood dust.

Carcinogenic Classification

MAK: Beech and oak wood dust — Group A1, capable of inducing malignant tumors as shown by experience with humans. Wood (except beech and oak) dust — Group B, justifiably suspected of having carcinogenic potential.

NIOSH: Hard wood — Carcinogen, with no further categorization. Soft wood — Carcinogen, with no further categorization.

IARC: Carpentry and joinery, Group 2B, possibly carcinogenic to humans. Furniture- and cabinet-making, Group 1, carcinogenic to humans. Lumber and sawmill industries and pulp and paper manufacture, Group 3, not classifiable as to their carcinogenicity.

Other Nations

Australia: certain hard woods as beech and oak, 1 mg/m^3, sensitizer; soft wood, 5 mg/m^3, sensitizer (both forms under review) (1990); Federal Republic of Germany: beech and oak wood dust, no MAK, Group A1, capable of inducing malignant tumors as shown by experience with humans, technical exposure limit (TRK), new installations 2 mg/m^3 total dust, others 5 mg/m^3 total dust, differentiation between dust samples from various kinds of wood is not at present possible in routine analysis; wood dust (except beech and oak wood dust), no MAK, sensitizer, Group B, justifiably suspected of having carcinogenic potential; technical exposure limit (TRK), new installations 2 mg/m^3 total dust, others 5 mg/m^3 total dust, differentiation between dust samples from various kinds of wood is not at present possible in routine analysis (1992); Sweden: 4 mg/m^3, carcinogen, 2 mg/m^3, if dust has unevaluable impregnated substances (1990); United Kingdom: hard wood 5 mg/m^3, sensitizer; soft wood 5 mg/m^3 (substance to be reviewed) (1991).

References

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