(1) Mistake if don't look @ key Materials on 12 Hr Basis
(2) Shift change I.H. situation
Exposure / PEL

GEN 55 (REV.6/74)

Interoffice Memorandum

TO (Name and Location)	DATE
J. N. Gann	January 27, 1982
FROM (Name and Location)	REFERENCE NO.
C.W. Whaley	CWW-294-82

PLAINTIFF'S EXHIBIT
CEL-124

SUBJECT: Impact of 12-hour Work Shift on the BCP Industrial Hygiene Program

On January 26, 1982 I discussed the potential impact of a 12-hour work shift on the BCP Industrial Hygiene Program with Messrs. M. R. Stenzel and G. A. Vos (Company Industrial Hygienists). We agreed that the 12-hour shift would have little or no economic impact on the plant from an industrial hygiene standpoint.

Chemical exposures in the plant are well below permissible limits so if these limits have to be reduced somewhat because of the extended shifts, exposures should still be within acceptable levels. Hearing protection requirements are in effect throughout the plant where ambient noise levels exceed 85 dB(A). Mr. Vos believes that with this control, employees will be well protected against hearing loss even with the extended work shift. In addition, our Noise Control Program (i.e., criteria for implementing engineering controls) will not be affected by extending the work shift.

There will be some impact on the Industrial Hygiene sampling and Health Monitoring Program such as:

1) The Industrial Hygiene Technician will have to work 12-hour days in order to obtain representative samples.

2) Permissible exposure limits for chemicals may have to be reduced (possibly to 2/3 of the existing PEL) because of the shorter recovery period between shifts.

3) The sampling and analytical program will be affected since most sampling procedures were developed to accommodate 6 to 8 hour samples. Sample periods will be extended to 10 to 12 hours thus requiring the use of multiple sampling tubes to prevent contaminant breakthrough.

4) A new version of the Industrial Hygiene Module exposure zones will have to be implemented to document the change to 12-hour shifts. This will enable us to study the chronic effects of chemical exposure for the extended work shift.

Carol Whaley
C. W. Whaley

CWW/gh
cc: C. J. Schaefer / Bob King / G. McCarthy / E. L. Tejml / L. E. Hackfeld
C. D. Barrett - Dallas
M. R. Stenzel - Dallas
G. A. Vos - Dallas

005871

OSHA SUBSTANCE TOXICITY TABLE

In categorizing violations as either serious or other-than-serious, primary consideration was given to the toxicologic properties of the chemical substance. The health codes are listed below. When a listing for a substance contains multiple health codes, only the three most serious appear. (See paragraph D, Chapter II of the Industrial Hygiene Field Operations Manual for further explanation).

HEALTH CODE NUMBER	HEALTH EFFECT
1	Cancer---Currently regulated by OSHA as carcinogens; chiefly work practice standards.
2	Chronic (Cumulative) Toxicity---Suspect carcinogen or mutagen
3	Chronic (Cumulative) Toxicity---Long-term organ toxicity other than nervous, respiratory, hematologic or reproductive
4	Acute Toxicity---Short-term high hazard effects
5	Reproductive Hazards---Fertility impairment or teratogenesis
6	Nervous System Disturbances---Cholinesterase inhibition
7	Nervous System Disturbances---Nervous system effects other than narcosis
8	Nervous System Disturbances---Narcosis
9	Respiratory Effects Other Than Irritation---Respiratory sensitization (asthma)
10	Respiratory Effects Other Than Irritation---Cumulative lung damage
11	Respiratory Effects---Acute lung damage/edema
12	Hematologic (Blood) Disturbances---Anemias
13	Hematologic (Blood) Disturbances---Methemoglobinemia
14	Irritation-Eye, Nose, Throat, Skin---Marked
15	Irritation-Eye, Nose, Throat, Skin---Moderate
16	Irritation-Eye, Nose, Throat, Skin---Mild
17	Asphyxiants, Anoxiants
18	Explosive, Flammable, Safety (No Adverse Effects Encountered When Good Housekeeping Practices are Followed)
19	Generally Low Risk Health Effects---Nuisance particulates, vapors or gases
20	Generally Low Risk Health Effects---Odor

OSHA Instruction CPL 2-2.20
April 2, 1979
Office of Field Coordination

EXPLANATION OF TABLE HEADINGS (Cont'd)

SUBSTANCE	HEALTH CODE NO.	CODE NO.	PHYSICAL STATE	PEL ppm	PEL mg/m^3	ADD. DATA	HEALTH EFFECTS	CLASSIFICATION OF VIOLATION	WIPE SAMPLING	WORK CATEGORY
1	2	3	4	5		6	7	8	9	10

9. WIPE SAMPLING - Substances which present a potential ingestion (I) hazard (1910.141(g)(2) and (g)(4) and/or skin(S) absorption hazard (1910.132(a) are identified in this column. For these substances wipe sampling should be considered when assessing an employee exposure. Blanks indicate present infeasibility of wipe sampling due to physical state of substance; lack of potential for significant physical harm; and/or technologic limitations. References: 1. Documentation of Threshold Limit Values, ACGIH, Fourth Edition, 1977 (including supplements); 2. Handbook of Toxicology, Vol 1, Acute Toxicities, W.S. Spector, editor, Philadelphia, 1956, W.G. Saunders Co. For additional information refer to Chapter VI in this manual.

10. PROLONGED WORK SCHEDULE CATEGORIES - This column indicates the code designation for prolonged work schedules which may require an adjustment to the PEL. (See Chapter XIII)

Category	Classification	Adjustment Criteria
1 A	Ceiling Standard	none
1 B	Irritants	none
1 C	Technologic limitations	none
2	Acute Toxicants	Exposed " 8 hrs/day
3	Cumulative Toxicants	Exposed " 40 hrs/week
4	Both Acute & Cumulative	Exposed " 8 hrs/day and or Exposed " 40 hrs/week

Note: The health effects and classification of violation sections of this chapter have been reviewed by a panel of toxicologists and industrial hygienists from NIOSH using policy guidelines established by OSHA.

EXPLANATION OF TABLE HEADINGS

SUBSTANCE	HEALTH CODE NO.	CODE NO.	PHYSICAL STATE	PEL ppm	PEL mg/m^3	ADD. DATA	HEALTH EFFECTS	CLASSIFICATION OF VIOLATION	WIPE SAMPLING	WORK CATEGORY
1	2	3	4	5		6	7	8	9	10

1. SUBSTANCE - The chemical name of the substance as cited by OSHA (e.g., 29 CFR 1910.1000, Tables Z-1, Z-2, or Z-3) or by the American Conference of Governmental Industrial Hygienists (ACGIH) (1977 Threshold Limit Values (TLVs^R) list). A "skin" designation refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either by airborne, or more particularly, by direct contact with the substance.

2. HEALTH CODE NUMBER - The number assigned reflects the most significant health hazard(s) posed by each substance (see page 2 for a complete description of each health code).

3. CODE NUMBER - The number currently assigned by OSHA to each compound for reporting specific violations in the field. Where substances do not have a code number, it means that they are new additions to the ACGIH TLV list or recommendations from NIOSH. A "C" preceding the code number indicates that the compound is regulated by OSHA as an occupational carcinogen.

4. PHYSICAL STATE OF SUBSTANCE AT STANDARD TEMPERATURE AND PRESSURE - S-solid; L-liquid; G-gas; FUM-fume; MIX-mixture; VAP-vapor; VAR-varies with individual compounds.

5. PEL - Permissible exposure limit as adopted by OSHA. A "C" in this column indicates a ceiling limit. An "NDS" in this column indicates that a citation under the OSHA nuisance dust standard (i.e., 29 CFR 1910.1000, Table Z-3) should be considered.

6. ADDITIONAL DATA - This column provides additional data to be considered in determining the classification of violation. "TLV" indicates that there is no OSHA PEL but that the ACGIH has recommended a Threshold Limit Value (TLV). "TLV-CHG" indicates that there is an OSHA PEL, but that the current TLV has been changed since the OSHA PELs were adopted from the 1968 ACGIH TLV values. "CD" indicates that a NIOSH Criteria Document has been prepared on this substance. "CIB" indicates that a National Institute for Occupational Safety and Health (NIOSH) Current Intelligence Bulletin has been issued for this substance. For certain substances additional data is provided in parenthesis to assist in locating the appropriate reference.

7. HEALTH EFFECTS - Principal effect(s) of exposure to each substance.

8. CLASSIFICATION OF VIOLATION - Ratings of violations as serious (S) or other-than-serious (O) are based upon data in the Documentation of Threshold Limit Values, ACGIH, Fourth Edition, 1977 (including supplements), a particular NIOSH Criteria Document or Current Intelligence Bulletin, the NIOSH Registry of Toxic Effects of Chemical Substances and other selected references.

SUBSTANCE	HEALTH CODE NO.	CODE NO.	PHYSICAL STATE	PEL ppm	PEL mg/m^3	ADD. DATA	HEALTH EFFECTS	CLASSIFICATION OF VIOLATION	WIPE SAMPLING	WORK CATEGORY
Abate	6	0005	S	-----	-----	TLV	Cholinesterase Inhibition	S-Above 30 mg/m^3	-----	3
Acetaldehyde	14	0010	L	200	360	TLV-CHG	Marked Irritation Eye, Nose, Throat, Skin	S	-----	1 B
Acetic Acid	14	0020	L	10	25	-----	Marked Irritation Eye, Nose, Throat, Skin	O-Up to 30 ppm S-Above 30 ppm	-----	1 B
Acetic Anhydride	14	0030	L	5	20	TLV-CHG	Marked Irritation Eye, Nose, Throat, Skin	S	-----	1 B
Acetone	16,8	0040	L	1000	2400	-----	Mild Irritation-Eye, Nose, Throat/Narcosis	O-Up to 2000 ppm S-Above 2000 ppm	----- -----	1 B
Acetonitrile	16,4	0060	L	40	70	CD	Mild Irritation-Eye, Nose, Throat/ Acute Toxicity (Cyanosis)	O-Up to 50 ppm S-Above 50 ppm	-----	4
2-Acetylamino-fluorene	1	C 0065	S	STD 1910.1014		-----	Cancer	S	1	1 C
Acetylene	18,17	0070	G	----	----	TLV,CD	Explosive/ Simple Asphyxiation	S-Above 2500 ppm	-----	1 C
Acetylene Dichloride				(See 1,2 Dichloroethylene)						
Acetylene Tetrabromide	3,10	0080	L	1	14	-----	Cumulative Liver and Lung Damage	S	-----	4

CHAPTER XIII

MODIFICATION OF PELs FOR PROLONGED EXPOSURE PERIODS

A. Purpose and Scope. The 1968 ACGIH Threshold Limit Values (TLVs) adopted by OSHA as permissible exposure limits (PELs) are directly related to assumed conventional exposure periods of no more than 8 hours/day, 40 hours/week.

1. The 8-hour exposure limits for some substances may not provide appropriate protection from health hazards when novel work schedules are utilized; e.g., exposures longer than 8 hours/day, four 10-hour days/week, six 7-hour days/week, etc. This chapter identifies those PELs which may inadequately protect workers for prolonged exposure periods and describes how an "adjusted PEL" may be calculated.

2. Instructions on sampling and citation procedures shall be sought from the Assistant Regional Administrator (ARA) for Technical Support who shall in turn contact the Directorate of Technical Support.

B. Procedure.

1. Each substance listed in the Substance Toxicity Table in Chapter II has been assigned to one of the six "Work Schedule" categories described in Figure XIII-1 on the basis of the 1968 Documentation of TLVs published by ACGIH.

2. During a health inspection, the Industrial Hygienist has the responsibility of documenting any work schedules resulting in excessive exposures to a hazardous substance caused by exposure periods longer than 8 hours/day or 40 hours/week. This would include routine overtime shifts.

3. The Industrial Hygienist should determine an "adjusted PEL" as necessary for each hazardous substance sampled, according to the specifications given for the category to which it is assigned.

4. No adjustment should be made to the PELs of substances in category 1. For all other categories, the equivalent PELs should be calculated according to the methods described in paragraphs C.1 through 6 and used as a professional guide or in the evaluation of actual employee risk.

5. In all situations, the equivalent PEL will be equal to or lower (i.e. more restrictive) than the PEL values listed in 29 CFR 1910.1000.

6. The Industrial Hygienist should also elicit from the employees and document any symptomatology that may be related to the exposure.

C. Work Schedule Categories.

1. Category 1A. Ceiling Limit Standards. Substances in this category (e.g., butylamine) have ceiling limit standards which were intended never to be exceeded at any time, and so, are independent of the length or frequency of work shifts. The ceiling PELs for substances in this category should not be adjusted.

2. Category 1B. Standards Preventing Mild Irritation. Substances in this category have a PEL designed primarily to prevent acute irritation or discomfort (e.g., cyclopentadiene). There are essentially no known cumulative effects resulting from exposures for extended periods of time at concentration levels near the PEL. The PELs for substances in this category should not be adjusted.

3. Category 1C. Standards Limited by Technologic Feasibility. The PELs of substances assigned to this category have been set either by technologic feasibility (e.g., vinyl chloride) or good hygiene practices (e.g., methyl acetylene). These factors are independent of the length or frequency of work shifts. The PELs for substances in this category should not be adjusted.

4. Category 2. Acute Toxicity Standards.

   a. The substances in this category have PELs which prevent excessive accumulation of the substance in the body during 8 hours of exposure in any given day (e.g., carbon monoxide).

   b. The following equation determines a level which ensures that employees exposed more than 8 hours/day will not receive a dosage (i.e. length of exposure X concentration) in excess of that intended by the standard.

$$\text{Equivalent PEL} = \text{8-hour PEL} \times \frac{8 \text{ hours}}{\text{hours of exposure in one day}} \qquad \text{(Equation XIII-1)}$$

   c. The Industrial Hygienist should normally conduct sampling for the entire shift minus no more than one hour for equipment set-up and retrieval (e.g., at least 9 hours of a 10-hour shift). In situations where an employee works multiple shifts in a day (e.g., two 7-hour shifts), and the Industrial Hygienist can document sufficient cause to expect exposure concentrations to be similar during the other shifts, the sampling should be done during only one shift.

5. Category 3. Cumulative Toxicity Standards

   a. Substances assigned to this category present cumulative hazards (e.g., lead, mercury, etc.). The PELs for these substances are designed to prevent excessive accumulation in the body resulting from many days or even years of exposure.

   b. The following equation ensures that workers exposed more than 40 hours/week will not receive a dosage in excess of that intended by the standard.

$$\text{Equivalent PEL} = \text{8-hour PEL} \times \frac{40 \text{ hours}}{\text{hours of exposure in one week}} \qquad \text{(Equation XIII-2)}$$

c. It is the responsibility of the Industrial Hygienist to conduct sufficient sampling to document exposure levels for the entire week when evaluating conditions on the basis of this equivalent PEL. For most operations the Industrial Hygienist will be able to sample during one shift only and then document sufficient cause to predict exposure concentrations during the other shifts.

6. Category 4. Acute and Cumulative Toxicity Standards. Substances in this category may present both an acute and a cumulative hazard. For this reason, the PELs of these substances should be adjusted by either equation XIII-1 or XIII-2; i.e. whichever provides the greatest protection.

7. Refined Adjustment Equations for Specific Standards. The adjustment equation presented for categories 2 and 3 reflect an oversimplification of the actual accumulation and removal of a toxic agent from the body. Additional research, however, is needed in order to apply more complex equations to estimate resulting body burden and health risk due to prolonged exposure periods. This chapter will be updated when the necessary data become available. Industrial Hygienists having sufficient data to validate adjusting PELs by a more rigorous method such as those proposed in the following articles are encouraged to do so following approval from the ARA for Technical Support:

Brief, R.S. and R.A. Scala, "Occupational Exposure Limits for Novel Schedules," Amer. Ind. Hyg. Assn. Jour. 36:467, 1975.

Roach, S.A., "A More Rational Basis for Air Sampling Programmes," Ann. Occup. Hyg. 20:65, 1977.

Hickey, J.L.S. and P.C. Reist, "Application of Occupational Exposure Limits to Unusual Work Schedules," Amer. Ind. Hyg. Assn. Jour. 38:613, 1977.

FIGURE XIII-1

Summary of Work Schedule Categories

Work Schedule Category	Principle Group Characteristic	Conditions Resulting In Adjustment	Adjustment Formula
1A	Ceiling limit standards	None	None
1B	Irritants	None	None
1C	Technologic limitations	None	None
2	Acute toxicity only	Exposed greater than 8 hours/day	Adj. PEL = PEL X 8 hours/ hours exposed/day
3	Cumulative toxicity only	Exposed greater than 40 hours/week	Adj. PEL = PEL X 40 hours/ hours exposed/week
4	Both acute and cumulative toxicity	Exposed greater than 8 hours/day and/or exposed greater than 40 hours/week	The equation for category 2 or 3, whichever results in the greatest protection

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