PLAINTIFF'S EXHIBIT

SH-1223

SM-32 (REV. 5-78)

Shell Oil Company
Interoffice Memorandum

I85-135

APRIL 2, 1986

FROM: MANAGER, HEALTH & SAFETY, MANUFACTURING & TECHNICAL

TO: SEE ATTACHED DISTRIBUTION LIST

SUBJECT: HS&E PROCEDURE FOR INDUSTRIAL HYGIENE MONITORING

Each manufacturing location has been conducting industrial hygiene monitoring for a number of years. During that period, we have used the monitoring results in a variety of ways which has tended to increase the demands and requirements on the data. At the same time, we have gained knowledge and experience in managing these programs to yield the desired results. We believe it is timely to organize what we have learned and developed into a common set of principles and practices which locations and Head Office can use in the administration of I.H. monitoring programs. A joint H.O. and location task force was formed for this purpose and has been working since early last year. The task force has completed a draft in the form of an HS&E Procedure (definition attached). A copy of the draft HS&E Procedure for Industrial Hygiene Monitoring is attached for your review.

An earlier, rough draft was reviewed by locations and H.O. I.H. personnel in May-June 1985. Comments from that review have been incorporated in this redraft. We delayed reissuing until now because we have been studying the possible use of a Du Pont program called LOGAN which provides both data analysis and monitoring strategy. Although the program remains of interest, Du Pont is not yet ready to offer the program for general use. We are therefore proceeding with our own work-product.

Included in this procedure is a material sampling priority (Attachment I). This applies only to this procedure and has not been designed for other uses or purposes. Please review the attachment for the materials at your location, and provide feedback regarding the prioritization of specific substances.

Please provide any comments directly to the task force leader, A. F. Schmit, HS&E, S&IH, IH Services. We would appreciate your comments by April 18, 1986.

JDR/AFS:BVR

Attachments

ENVIRONMENTAL/IND. HYGIENE	
4/7/86	NAME T E Gillespie
	Return Document to File
X	Record Copy in File
	Information Copy
Record Copy in ECB Sat.	
Copy: BTW PJS/WBA	
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LAM 000747

CAD8606301

DPMC-16449

cc - Head Office
P. M. Bryant (w/attach.)
C. F. Phillips (w/o attach.)
A. F. Schmit (w/o attach.)

Manufacturing Locations
M. T. Barclay, Geismar Chemical Plant
T. A. Colangelo, Norco Mfg. Complex
W. M. Cunningham, Wood River Mfg. Complex
F. J. Gorski, Woodbury Chemical Plant
M. B. Kovacevich, Martinez Mfg. Complex
A. K. Menard, Norco Mfg. Complex
S. V. Sever, Wilmington Mfg. Complex
P. J. Snyder/W. B. Austin, Deer Park Mfg. Complex

Shell Development Company
W. S. Gleason, Westhollow Research Center

DISTRIBUTION LIST

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Anacortes Refinery
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Marietta Plant
Manager, Health, Safety and Environment

Martinez Manufacturing Complex
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Odessa Refinery
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Taft Plant
Safety and Training Representative

Wilmington Manufacturing Complex
Manager, Health and Safety

Woodbury Plant
Manager, Health, Safety and Environment

Wood River Manufacturing Complex
Manager, Safety and Industrial Hygiene

Shell Development Company

Westhollow Research Center
Manager, Health, Safety and Environment

Attachment

HS&E Procedure

A particular way of accomplishing an activity which has been developed to assist effective implementation of that activity throughout Shell. Procedures may be modified to adapt to needs of a specific organization by agreemment between that organization and the responsible HS&E department manager and the functional managers responsible for the particular health, safety or environmental issue. When the procedure could have a significant business impact, concurrence of the Plans, Support and Integration Manager is required.

HS&E PROCEDURE FOR INDUSTRIAL HYGIENE MONITORING

I. Introduction

Industrial hygiene monitoring has been routinely conducted at Shell locations to measure chemical, noise, heat, and radiation exposures. The monitoring typically involves personal sampling of the potentially exposed employees but may also include area and source air sampling as well. The monitoring is conducted for one or more of the following reasons.

A. To comply with monitoring requirements in OSHA Health Standards (Asbestos, Ethylene Oxide, Vinyl Chloride, etc.).

B. To evaluate compliance with OSHA Permissible Exposure Limits (PELs).

C. To evaluate compliance with Shell Internal Standards (SISs).

D. In support of Shell Medical Surveillance Programs (Benzene, Asbestos, etc.).

E. To investigate special concerns such as:

1. Employees with recognized health effects
2. Medical concerns
3. Employee Complaints
4. Toxicology interests
5. Regulatory changes and requests for information

F. To evaluate the effect of an engineering or procedural change on exposure level.

G. In response to an emergency (spill, leak, etc.).

H. In support of epidemiology studies.

Most existing OSHA Standards (29 CFR 1910.1000) merely specify a PEL above which employees should not be exposed. There are no formal monitoring requirements for the approximately 400 chemicals in this category.

II. Purpose

Initially industrial hygiene monitoring was conducted to evaluate compliance with allowable exposure limits (i.e., PELs, SISs) and to maintain surveillance through periodic monitoring. While this basic purpose remains, the demands on our industrial hygiene monitoring program have expanded. The monitoring data has been used increasingly to arrive at decisions regarding capital expenditures for exposure control, in submissions to trade organizations and Federal agencies to influence regulatory activity, and for in-house risk assessments to name a few of the major uses. Because of the

significant decisions that rely on monitoring data, it is essential to continue emphasis and quality in our programs. For these reasons, a procedure consisting of basic principles and direction in the conduct of I.H. monitoring and evaluation of I.H. monitoring data has been developed. The procedure addresses:

A. How many samples are needed to make a decision?
B. How should the data be evaluated?
C. What is the right amount of repeat or periodic monitoring?

The procedure provides a methodology for conducting and interpreting I.H. monitoring. It is based largely on our experiences and judgements and makes use of limited statistical analyses. Its development also included extensive review of published sampling strategies and statistical workups by NIOSH, OSHA, academia, and industry. Where practical and beneficial, information and methods from these sources were incorporated. Since there is continuing research and study on the subject of I.H. sampling strategy, the procedure will be periodically reviewed for change and improvements.

The OSHA sampling strategy in many of its health standards is based on exceeding the PEL or an action level (usually one-half of the PEL). This procedure makes use of this concept, but more fully defines the minimum sampling requirements to improve the probability of correctly judging compliance. Our goal is to make accurate decisions with the minimum required amount of data.

For the purposes of evaluating monitoring data, this procedure assumes substantial compliance is achieved when exposures are at or below the OSHA PEL or Shell Internal Standard at least 95% of the time. This determination is included in the definition of the Shell Internal Standard and it is also the criteria NIOSH has previously recommended.

The monitoring strategy in this procedure assumes the industrial hygienist and/or industrial hygiene technician uses his and/or her best judgement in accounting for variables such as weather, seasonal changes, process upsets, differences in workshifts, etc. The following procedures are considered as minimums, and it is anticipated additional samples may be required to evaluate numerous variables which may exist, or in some circumstances to comply with specific OSHA Health Standards.

III. Initial Monitoring Strategy

If industrial hygiene monitoring has not previously been conducted or if significant changes in the work place or work practices have occurred and previous data may no longer be representative, then the following steps are appropriate.

A. Qualitative Assessment

1. Identify jobs (JEPs) with the potential chemical and/or physical agent exposure.

2. Assess relative exposure potential for each JEP (highest to lowest)

B. Quantitative Assessment

Industrial hygiene monitoring is typically conducted on a job (JEP) basis. That is, the monitoring or sampling data is considered representative of the job's exposures. Therefore the number of samples collected must be adequate to take into account the day-to-day and shift-to-shift variability of exposures in the job and the variability between individuals when more than one work the job. For this reason a number of samples is usually required for initial evaluation. The following tables recommend the minimum number of samples per JEP, and the minimum number of individuals and shifts to be sampled. The recommended minimum increases with the number of individuals working in the job. Since the following recommendations are minimums, judgment should be used in collecting more samples if the JEP has significant work task variation from day-to-day and/or shift-to-shift. Since nearly all JEPs may be described as being either rotating or fixed shifts, separate tables for each have been developed.

TABLE 1
Minimum Number of Samples (TWA) to be Collected

1. Fixed Shifts (employees generally work same shift each day, i.e., five, 8-hour days or nights)

Number Employees per JEP	Percent Employees to be Sampled	# Shifts to be Sampled[1,2]	Min. # Samples per JEP
1 - 2	100	3 - 5	5 - 6
3 - 5	at least 50	3 - 5	6 - 8
6 - 10	at least 33	4 - 5	8 - 12
11+	approx. 25	4 - 5	12

2. Rotating Shifts

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Number Employees per shift per JEP	Number Employees per JEP[3]	Percent Employees to be sampled	Min. # Samples per JEP[1,4]
1 - 2	4 - 8	at least 50	6 - 9
3 - 4	12 - 16	at least 25	9 - 12

[1] Should include day and night shifts if there are differences in exposure potential between shifts.
[2] Should consider sampling at higher range of shifts with few employees per shift.
[3] Assumes four employees required to cover job with one employee per shift, rotating shifts, 24 hours per day, seven days per week.
[4] Assumes % of employees (from preceding column) who can work the JEP are sampled 3-5 shifts each.

The following examples illustrate the use of these tables.

Example 1: Assume 4 painters work straight days (fixed shifts), and solvent exposure levels need to be determined. Table 1 recommends sampling at least 2 of the 4 painters (50%) for 3-5 different workdays. This would result in a minimum of 6 samples. To improve the representativeness of the data, consider dividing the 6 samples among all 4 painters or as many of them as possible. Also, the 6 samples need not be collected just on 2 painters for each of 3 days. The sampling could be spread over more than 3 days and possibly improve the representativeness of the data.

Example 2: Assume a Dockman works rotating 8-hour shifts round the clock each day of the year and benzene exposure levels need to be determined. There are 3 Dockmen working on any one shift, with a total of 12. The Dockmen load one barge of benzene per week. According to Table 1, at least 9 samples should be collected. They should be collected on as many different dockmen as possible but on no less than 3 (25% of 12) different dockmen. It may take several weeks to complete sampling for the initial monitoring since only 1 benzene barge is loaded per week.

IV. Analysis of Initial Monitoring Results

The minimum number of samples specified in Section III are necessary in order to perform the following statistical test and screen of the data. The purpose of the statistical test is to screen the initial results into data sets which clearly fall below the allowable exposure limit* (AEL) or which require more samples to determine compliance or non-compliance. For those data sets clearly below the AEL, an appropriate frequency of periodic monitoring is established based on relative exposure to the AEL and the potential hazard of the material. For example, the greater the health hazard or the closer the data are to the AEL, more frequent follow-up monitoring is indicated for that JEP.

The statistical test consists of comparing the 80% upper confidence limit of the geometric mean of the data to the AEL. This parameter was selected after examining numerous existing data sets. It was found to be a relatively reliable indicator for initial compliance screening when used in the following manner.

TABLE 2

80% Upper Confidence Limit of the Geometric Mean[1]	Category
> AEL	D
> .5 x AEL but ≦ AEL	C
> .1 x AEL but ≦ .5 x AEL	B
≦ .1 x AEL	A

*May be the PEL, TLV, SIS, or other exposure limit for which a compliance determination is necessary.

The corresponding actions for each of the categories are as follows[2]:

TABLE 3

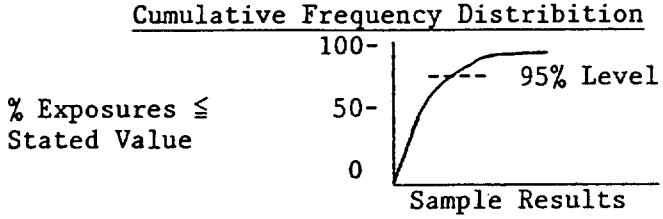
Category	Action: Materials of Priority I[3]	Action: Materials of Priority II[3]
A	Repeat initial monitoring biennially (1x/2 yr)	Repeat initial monitoring if there are significant changes in workplace/ work practices
B	Repeat initial monitoring annually	Repeat initial monitoring biennially (1x/2 yr)
C	Collect minimum of 20 TWA samples within three months and plot on cumulative frequency distribution graph per Section V.	
D	Collect minimum of 20 TWA samples within one month and plot on cumulative frequency distribution graph per Section V.	

[1] 80% upper confidence limit of the geometric mean can be calculated as follows: 80% UCL = $\bar{x} + .842\ s/\sqrt{n}$ (calculate using log transformed data, then convert)
This calculation is also available in Stat-Graph.
[2] If any sample equals or exceeds the AEL, the recommending sampling strategy should move up one category, e.g., B to C.
[3] See Attachment I

V. Analysis of Expanded Monitoring Results

This step in the procedure should be applied when sufficient data, initial and routine monitoring, has been collected to ascertain both compliance and non-compliance with the AEL and the appropriate frequency of periodic monitoring. This step may also be useful in analyzing data in an on-going periodic monitoring program for trend analysis, analyzing the impact of a change in the AEL, reestablishing a suitable periodic monitoring frequency, etc.

The additional data available at this step permits the use of the cumulative frequency distribution method to determine directly whether JEP exposures are in substantial compliance (i.e., 95% of the monitoring results are at or below the AEL). The cumulative frequency plot is illustrated below and the method is available on Stat-Graph. An example of a Stat-Graph Plot is included as Attachment II.



The results of this analysis should be compared to Table 4 to determine appropriate periodic monitoring frequency. The monitoring frequency is a function of 2 factors: 1) the exposure levels relative to the AEL; and 2) the health hazard of the material. The monitoring frequency is increased as the exposure levels approach the AEL and as the potential health hazard increases. The exception is the situation where we are not in substantial compliance (i.e. 95% level of cumulative frequency distribution exceeds AEL) and further engineering controls and/or work practices to reduce exposure are infeasible. In this case, suggested monitoring is less frequent with more emphasis placed on compliance using personal protective equipment (PPE).

In some cases, the recommended periodic monitoring frequency may not provide sufficient data to permit statistical analysis for one or more years. However, these cases are limited to situations and JEPs which are already under relatively good control and for which exceeding the AEL is unlikely.

TABLE 4

95% Level of Cumulative Frequency Distribution	Frequency of Monitoring (samples per JEP per year) For Materials of Priority I	For Materials of Priority II
≧ PEL (no controls* feasible)	Repeat initial monitoring strategy biennially or following significant workplace and/or work practice changes	
≧ PEL (controls under study)	12 (1/month)	4 (1/quarter)
< PEL ≧ 0.5 PEL	8 (2/quarter)	2 (1/6 months)
< 0.5 PEL ≧ 0.1 PEL	4 (1/quarter)	1
< 0.1 PEL	Repeat initial monitoring strategy biennially.	

*Assumes engineering controls are not feasible; however, appropriate PPE is in use.

VI. Additional Information

There are additional considerations which can impact and modify the foregoing procedure. Guidance in some of the major areas is included as attachments.

Attachment III	Personal Sample Type Definitions Peak/Task Sample Frequency Offshift Sampling
Attachment IV	Multiple/Cumulative Exposures
Attachment V	OSHA Monitoring Requirements in Health Standards
Attachment VI	Exposure Monitoring for Maintenance Turnarounds

ATTACHMENT I

MATERIAL SAMPLING PRIORITY

In addition to exposure potential, the hazard of the material is a factor in establishing industrial hygiene sampling strategy. In general, the more hazardous the material, the greater the need for industrial hygiene monitoring. For example, a known human carcinogen will likely require more frequent industrial hygiene monitoring than a nuisance dust.

To take into account the significance of hazard, two sampling priorities, I and II, are established. They are defined as follows:

Priority I

Materials which have the potential to produce irreversible acute or chronic health effects, e.g., carcinogens, reproductive hazards, neurotoxins, hepatoxins, fibrosis-producing dusts, etc.

Examples: Benzene, Vinyl Chloride, Epichlorohydrin, Oxitol (2-ethoxyethanol), Inorganic and Organic Lead, Ethylene Oxide, Ethylene Dibromide, Asbestos, Crystalline Silica, Hydrogen Sulfide, Chlorine, all materials included in the Protection of the Embryo/Fetus Policy.

Priority II

Materials which may produce only reversible acute or chronic health effects including typically irritants and nuisance dusts.

Examples: Acetone, Isopropyl Alcohol, VM&P Naphtha.
Materials for which there is industrial hygiene monitoring data in the Health Surveillance System have been reviewed and categorized as follows:

CONTAMINANT CODES (ALPHABETICALLY) - REVISED 4/86

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS.
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 709	ACENAPHTHALENE	
900 710	ACENAPHTHENE	
900 722	ACETALDEHYDE	
900 632	ACETIC ACID	
900 501	ACETONE	
900 603	ACETONITRILE	
900 502	ACROLEIN	I
900 503	ALDICARB	
900 504	ALLYL ALCOHOL	I
900 505	ALLYL CHLORIDE	I
900 506	ALLYL GLYCIDYL ETHER	
900 003	ALPHA RADIATION	
900 401	ALUMINUM (AS FUME)	
900 507	AMMONIA	
900 663	ANILINE	
900 705	ANTHRACENE	I
900 402	ANTIMONY	
900 403	ARSENIC	I
900 508	ASBESTOS	I
900 801	ASPHALT FUMES	I
900 509	ATRAZINE	
900 510	AZODRIN	
900 404	BARIUM	
900 711	BENZ (A) ANTHRACENE	I
900 708	BENZ (A) PYRENE	I
900 511	BENZENE	I
900 728	BENZENE SOLUBLES, PNA	I
900 712	BENZO (B) FLUORANTHENE	I
900 714	BENZO (GHI) PERYLENE	I
900 713	BENZO (K) FLUORANTHANE	I
900 004	BETA RADIATION	
900 512	BIDRIN	
900 800	BIS PHENOL A	
900 406	BISMUTH	
900 513	BLADEX	
900 453	BROMINE	
900 628	BUTADIENE	I
900 672	BUTOXYETHANOL, 2	I
900 515	BUTYL ALCOHOL (N-BUTANOL)	
900 601	BUTYL CRESOL	

*Listed for the purpose of establishing IH sampling priority.
This category is not intended for any other purpose.
Those substances not designated with 'I' are considered Priority II.

LAM 000758

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS..
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 516	BUTYL GLYCIDYL ETHER	
900 545	BUTYLATED HYDROXY TOLUENE	
900 409	CADMIUM	I
900 410	CALCIUM	
900 517	CARBON DIOXIDE	
900 518	CARBON DISULFIDE	I
900 519	CARBON MONOXIDE	
900 520	CARBON TETRACHLORIDE	I
900 803	CATALYST DUST TOTAL	
900 810	CATALYST DUST, RESPIRABLE	
900 851	CERAMIC FIBERS	
900 412	CHLORINE	
900 848	CHLOROBIPHENYLS	I
900 691	CHLOROETHANE	
900 521	CHLOROFORM	I
900 414	CHROMIUM (HEXAVALENT)	I
900 413	CHROMIUM (TOTAL)	
900 707	CHRYSENE	I
900 522	CIODRIN	
900 795	COAL DUST, RESPIRABLE	
900 820	COAL DUST, TOTAL	
900 415	COBALT	
900 699	COBALT CARBONATE	
900 002	COLD	
900 450	COPPER (SOLUBLE)	
900 416	COPPER (TOTAL)	
900 523	CRESYL GLYCIDYL ETHER	
900 524	CUMENE	
900 684	CYANIDES (SALTS)	I
900 525	CYANURIC CHLORIDE	I
900 526	CYCLOHEXANE	
900 527	D-D	
900 528	DIACETONE ALCOHOL	
900 675	DIALLYLAMINE	
900 715	DIBENZ (A,H) ANTHRACENE	I
900 530	DIBROM	
900 573	DIBROMO METHANE	
900 586	DIBROMOCHLOROPROPANE	I
900 531	DICHLOROBENZENE (ORTHO)	
900 692	DICHLOROETHANE 1,1-	
900 634	DICYCLOPENTADIENE	

*Listed for the purpose of establishing IH sampling priority.
This category is not intended for any other purpose.
Those substances not designated with 'I' are considered Priority II.

LAM 000759

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS.
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 646	DIETHANOL AMINE	
900 729	DIETHYL SULFATE	
900 638	DIETHYLENE GLYCOL	
900 731	DIMETHYL ANILINE	
900 572	DIMETHYL DISULFIDE	
900 532	DIMETHYL METHYL PHOSPHONATE	
900 533	DIMETHYL PHOSPHONATE	
900 581	DIOXANE	
900 810	DUST-CATALYST, RESPIRABLE	
900 803	DUST-CATALYST, TOTAL	
900 795	DUST-COAL, RESPIRABLE	
900 820	DUST-COAL, TOTAL	
900 791	DUST-FLEXICOKER, RESPIRABLE	
900 850	DUST-FLEXICOKER, TOTAL	
900 804	DUST-INERT, RESPIRABLE	
900 054	DUST-INERT, TOTAL	
900 532	DIMETHYL METHYL PHOSPHONATE	
900 533	DIMETHYL PHOSPHONATE	
900 581	DIOXANE	
900 810	DUST-CATALYST, RESPIRABLE	
900 803	DUST-CATALYST, TOTAL	
900 795	DUST-COAL, RESPIRABLE	
900 820	DUST-COAL, TOTAL	
900 791	DUST-FLEXICOKER, RESPIRABLE	
900 850	DUST-FLEXICOKER, TOTAL	
900 804	DUST-INERT, RESPIRABLE	
900 054	DUST-INERT, TOTAL	
900 798	DUST-PETROLEUM COKE, RESPIRABLE	
900 849	DUST-PETROLEUM COKE, TOTAL	
900 808	DUST-SILICA, AMORPHOUS	
900 792	DUST-SILICA, RESPIRABLE (QUARTZ)	I
900 812	DUST-SILICA, TOTAL (QUARTZ)	I
900 439	DUST-SULFUR	
900 811	DUST-SYNTHETIC BLASTING (NON SILICA-RESPIRABLE)	
900 799	DUST-SYNTHETIC BLASTING (NON SILICA-TOTAL)	
900 443	DUST-VANADIUM (AS V205)	I
900 700	DUST-VANADIUM (AS V205) RESPIRABLE	I
900 534	EPICHLOROHYDRIN	I
900 656	ETHOXYETHANOL, 2 (EGMEE)	I
900 682	ETHOXYETHYLACETATE, 2 (EGMEEA)	

*Listed for the purpose of establishing IH sampling priority. LAM 000760
This category is not intended for any other purpose.
Those substances not designated with 'I' are considered Priority II.

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS.
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 535	ETHYL ACETATE	
900 536	ETHYL ALCOHOL	
900 582	ETHYL AMINE	
900 622	ETHYL AMYL KETONE	
900 537	ETHYL BENZENE	
900 698	ETHYL HEXANOL, 2	
900 685	ETHYL TOLUENE	
900 623	ETHYLENE DIAMINE	
900 538	ETHYLENE DIBROMIDE	I
900 539	ETHYLENE DICHLORIDE	I
900 639	ETHYLENE GLYCOL	
900 540	ETHYLENE OXIDE	I
900 643	FERROUS OXIDE	
900 827	FIBERGLASS	
900 791	FLEXICOKER DUST, RESPIRABLE	
900 850	FLEXICOKER DUST, TOTAL	
900 716	FLUORANTHENE	
900 717	FLUORENE	
900 576	FORMALDEHYDE	I
900 825	FUME - VANADIUM, (AS V205)	I
900 801	FUMES - ASPHALT	I
900 809	FUMES - WELDING, TOTAL	
900 683	FURFURAL	
900 667	GAMMA GLYCIDOXY PROPYL TRIMETHOXY SILANE	
900 005	GAMMA/X-RAY RADIATION	
900 805	GASOLINE, (AS TOTAL HYDROCARBONS)	
900 664	GLACIAL ACRYLIC ACID	
900 001	HEAT	
900 541	HEPTANE	
900 542	HEXANE, NORMAL	I
900 637	HEXYLENE GLYCOL	
900 010	HIGH PRESSURE	
900 644	HYDRAZINE	I
900 844	HYDROCARBON, TOTAL (NOT GASOLINE)	
900 730	HYDROGEN BROMIDE	
900 649	HYDROGEN CHLORIDE	
900 585	HYDROGEN CYANIDE	I
900 543	HYDROGEN FLUORIDE	
900 544	HYDROGEN SULFIDE	

*Listed for the purpose of establishing IH sampling priority. This category is not intended for any other purpose. Those substances not designated with 'I' are considered Priority II.

LAM 000761

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS.
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 718	INDENO (1,2,3,C,D,) PYRENE	
900 804	INERT DUST, RESPIRABLE	
900 054	INERT DUST, TOTAL	
900 006	INFRARED RADIATION	
900 545	IONOL (BHT)	
900 420	IRON	
900 695	ISOBUTYL ALCOHOL	
900 652	ISOPENTANE	
900 679	ISOPRENE	
900 546	ISOPROPYL ALCOHOL	
900 583	ISOPROPYL AMINE	
900 630	ISOPROPYL ETHER	
900 012	LASER RADIATION	
900 422	LEAD-INORGANIC, AS PB	I
900 421	LEAD-ORGANIC, AS PB (NOT TEL/TML)	I
900 629	LEAD-TETRA ETHYL AND TETRAMETHYL, AS PB	I
900 448	LITHIUM	
900 011	LOW PRESSURE	
900 723	M-PHENYLENEDIAMINE	
900 423	MAGNESIUM	
900 424	MANGANESE	
900 830	MERCAPTANS, TOTAL	
900 425	MERCURY	I
900 624	MESITYL OXIDE	
900 547	METHANOL	
900 658	METHOXY ETHANOL, 2 (EGMME)	
900 548	METHYL BUTYL KETONE	
900 549	METHYL CHLORIDE	
900 550	METHYL ETHYL KETONE	I
900 631	METHYL ISOBUTYL CARBINOL	
900 551	METHYL ISOBUTYL KETONE	
900 625	METHYL ISOCYANATE	I
900 650	METHYL TERTIARY BUTYL ETHER	
900 606	METHYL THIOACETALDOXIME	
900 584	METHYLENE CHLORIDE	I
900 694	METHYLENE DIANILINE 4,4'-	
900 008	MICROWAVE	
900 427	MOLYBDENUM (INSOL)	
900 426	MOLYBDENUM (SOL)	
900 447	MOLYBDENUM (TOTAL)	
900 677	MONOALLYLAMINE	

*Listed for the purpose of establishing IH sampling priority. LAM 000762
This category is not intended for any other purpose.
Those substances not designated with 'I' are considered Priority II.

THESE ARE THE CONTAMINANT CODES TO BE USED ON IH SAMPLING FORMS.
THIS LIST REPLACES ALL PREVIOUS LISTS.
DO NOT USE ANY CONTAMINANT CODES WHICH DO NOT APPEAR ON THIS LIST.

CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 662	MONOETHANOLAMINE	
900 570	MONOMETHYLAMINE	
900 571	MONOMETHYLCHLOROACETOACETAMIDE	
900 515	N-BUTANOL	
900 614	N-NITROSODIBUTYLAMINE	
900 612	N-NITROSODIETHYLAMINE	
900 611	N-NITROSODIMETHYLAMINE	
900 613	N-NITROSODIPROPYLAMINE	
900 617	N-NITROSOMORPHOLINE	
900 615	N-NITROSOPIPERIDINE	
900 616	N-NITROSOPYROLLIDINE	
900 719	NAPHTHALENE	
900 014	NEUTRON RADIATION	
900 460	NICKEL (SOLUBLE), AS NI	I
900 446	NICKEL (TOTAL)	
900 552	NICKEL CARBONYL, AS NI	I
900 428	NICKEL CHLORIDE	
900 429	NICKEL METAL	
900 455	NICKEL OXIDE	
900 466	NICKEL SUBSULFIDE	
900 610	NITRIC ACID	
900 553	NITROGEN DIOXIDE	
900 000	NOISE	
900 607	NONANE	
900 720	NONANOL	
900 554	NUDRIN	
900 574	OCTANE	
900 721	OCTENE (ISOMERS)	
900 806	OIL MIST	
900 421	ORGANIC LEAD, AS PB (NOT TEL/TML)	I
900 587	ORTHO CHLORO BENZOIC ACID	
900 666	ORTHODIMETHOXYBENZENE	
900 555	OZONE	
900 589	P-CRESOL	
900 633	PENTANE	
900 619	PENTOXONE	
900 798	PETROLEUM COKE DUST, RESPIRABLE	
900 849	PETROLEUM COKE DUST, TOTAL	
900 704	PHENANTHRENE	I
900 620	PHENOL	
900 556	PHENYL GLYCIDYL ETHER	

*Listed for the purpose of establishing IH sampling priority.
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CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 724	PHORONE	
900 557	PHOSDRIN	
900 640	PHOSGENE	
900 431	PLATINIUM METAL	
900 836	PLATINUM (SOL SALTS), AS PT	
900 728	PNA, BENZENE SOL. FRACTION	
900 807	PNA'S	
900 709	PNA'S ACENAPHTALENE	I
900 710	PNA'S ACENAPHTHENE	I
900 705	PNA'S ANTHRACENE	I
900 711	PNA'S BENZ (A) ANTHRACENE	I
900 708	PNA'S BENZ (A) PYRENE	I
900 712	PNA'S BENZO (B) FLUORANTHENE	I
900 714	PNA'S BENZO (GHI) PERYLENE	I
900 713	PNA'S BENZO (K) FLUORANTHANE	I
900 707	PNA'S CHRYSENE	I
900 715	PNA'S DI BENZ (A,H) ANTHRACENE	I
900 716	PNA'S FLUORANTHENE	I
900 717	PNA'S FLUORENE	I
900 718	PNA'S INDENO (1,2,3,C,D) PYRENE	I
900 719	PNA'S NAPHTHALENE	I
900 704	PNA'S PHENANTHRENE	I
900 706	PNA'S PYRENE	I
900 848	POLYCHLORINATED BIPHENYLS	I
900 432	POTASSIUM	
900 558	PYDRIN	
900 706	PYRENE	
900 559	RABON	
900 003	RADIATION-ALPHA	
900 004	RADIATION-BETA	
900 005	RADIATION-GAMMA/X-RAY	
900 006	RADIATION-INFRARED	
900 012	RADIATION-LASER	
900 008	RADIATION-MICROWAVE	
900 014	RADIATION-NEUTRON	
900 007	RADIATION-ULTRAVIOLET	
900 618	RM 17 + OXIDES	
900 647	SECONDARY BUTYL ALCOHOL	
900 577	SHOP LIGAND	
900 808	SILICA-AMORPHOUS	
900 792	SILICA-RESPIRABLE, (QUARTZ)	I
900 812	SILICA-TOTAL (QUARTZ)	I

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CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 436	SILVER	
900 591	SILVER AMINO OXALATE	
900 590	SILVER OXALATE	
900 641	SODIUM HYDROXIDE	
900 841	STODDARD SOLVENT	
900 560	STYRENE	I
900 561	SULFUR DIOXIDE	
900 439	SULFUR DUST	
900 609	SULFUR TRIOXIDE	
900 696	SULFURIC ACID	
900 811	SYNTHETIC BLASTING (NON SILICA-RESPIRABLE) DUST	
900 799	SYNTHETIC BLASTING (NON SILICA-TOTAL) DUST	
900 627	TERTIARY BUTYL TOLUENE	
900 626	TERTIARY BUTYL ALCOHOL	
900 602	TERTIARY BUTYL BENZENE	
900 608	TERTIARY BUTYL BENZOIC ACID (PARA)	I
900 629	TETRA ETHYL AND TETRA METHYL LEAD, AS PB	I
900 689	TETRACHLOROETHYLENE	
900 562	TETRAHYDROFURAN	
900 440	TIN (INORGANIC)	
900 452	TIN (ORGANIC)	
900 441	TITANIUM	
900 575	TITANIUM TRICHLORIDE	
900 563	TOLUENE	I
900 660	TOLUENE DIISOCYANATE	I
900 054	TOTAL DUST, INERT	
900 676	TRIALLYLAMINE	
900 578	TRICHLOROBENZENE	
900 579	TRICHLOROETHANE	I
900 688	TRICHLOROETHANE, 1,1,2-	
900 564	TRICHLOROETHYLENE	I
900 681	TRICHLOROPROPANE 1,2,3	
900 648	TRIETHYLAMINE	
900 693	TRIETHYLENE GLYCOL	
900 657	TRIMELLITIC ANHYDRIDE	I
900 565	TRIMETHYL PHOSPHATE	
900 566	TRIMETHYL PHOSPHITE	
900 686	TRIMETHYLBENZENE 1,2,4	
900 580	TRIPHENYL PHOSPHINE	
900 680	TRIPHENYLPHOSPHONIUM ETHYL IODINE	
900 442	TUNGSTEN (SOL)	
900 013	ULTRASONIC	

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CONTAMINANT CODES	AIR CONTAMINANT	MATERIAL SAMPLING PRIORITY*
900 007	ULTRAVIOLET RADIATION	
900 443	VANADIUM - DUST (AS V205)	I
900 825	VANADIUM FUME (AS V205)	I
900 700	VANADIUM (AS V205), RESPIRABLE DUST	I
900 567	VAPONA	
900 009	VIBRATION	
900 568	VINYL CHLORIDE MONOMER	I
900 725	VM&P NAPHTHA	
900 809	WELDING FUMES, TOTAL	
900 569	XYLENE, O-, M-, P-ISOMERS	
900 444	ZINC OXIDE	
900 692	1,1-DICHLOROETHANE	
900 688	1,1,2 TRICHLOROETHANE	
900 681	1,2,3 TRICHLOROPROPANE	
900 686	1,2,4 TRIMETHYLBENZENE	
900 674	2-(2-BUTOXYETHOXY) ETHANOL	
900 673	2-(2-ETHOCYETHOXY) ETHANOL	
900 672	2-BUTOXYETHANOL	I
900 656	2-ETHOXYETHANOL, (EGMEE)	I
900 682	2-ETHOXYETHYLACETATE (EGMEEA)	
900 698	2-ETHYL HEXANOL	
900 658	2-METHOXY ETHANOL, (EGMME)	I
900 694	4,4'-METHYLENE DIANILINE	

*Listed for the purpose of establishing IH sampling priority.
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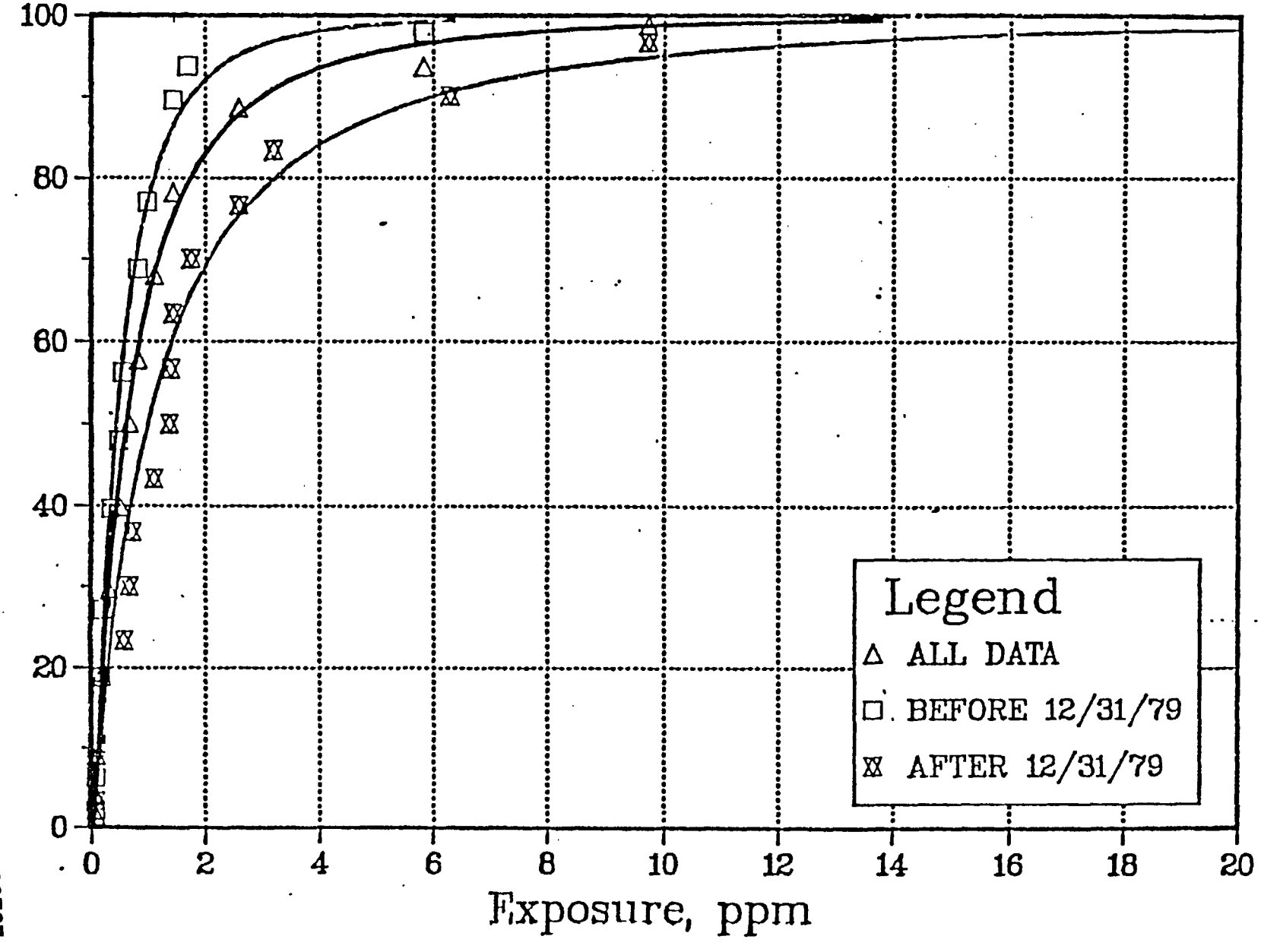
Cumulative Frequency Plot

LOCATION : GEISMAR PLANT
SUBSTANCE: ETHYLENE OXIDE
JEP : PROCESS TECH – EO–1 – TWA



ATTACHMENT II

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ATTACHMENT III

PERSONAL SAMPLE TYPE DEFINITIONS

TWA - (Time-Weighted Average) is a sample with a minimum sample time of the full shift less one hour, i.e., 7 of 8, 9 of 10, or 11 of 12 hours. If the sample time is less than this minimum but zero exposure time for the unsampled period can be and is documented, then the sample can be considered a TWA. The "TWA Determination Section" of the Industrial Hygiene Sample Form should be completed according to previously issued instructions. If a sample is intended to be a TWA, but the minimum sample time as defined above is not achieved, the "TWA Determination Section" of the Sample Form should be completed as "TWA Cannot Be Calculated".

Peak - Samples represent specific short-term tasks ranging from 1-30 minutes in duration. When feasible, try to attain a sample time of 15 minutes of duration of the task, not to exceed 30 minutes.

Task - Samples represent specific tasks exceeding 30 minutes duration, but not representative of the TWA exposure. Examples of such tasks would be loading/unloading of a tank car or truck, gauging, or decontaminating a pump for maintenance.

PEAK/TASK SAMPLE FREQUENCY

Peak samples (or task if duration exceeds 30 minutes) should be taken in conjunction with TWA sampling during initial determination of high concern chemicals. This sampling should be done regardless of the OSHA peak/ceiling or ACGIH STEL status for the chemical being monitored. The purpose of this monitoring is to further characterize the exposure profile of the job. Subsequent samples should be taken if initial TWA determination results in Categories B, C or D.

OFFSHIFT SAMPLING

Jobs with multiple or rotating shifts should be evaluated for differences in job activities between shifts. It is normally most practical to sample on day shifts and this is appropriate where activities on all shifts are virtually the same. However, if exposure potential varies with the shift, it will probably be necessary to consider alternate means of collecting representative data.

ATTACHMENT IV

MULTIPLE EXPOSURES WITH POTENTIALLY ADDITIVE HEALTH EFFECTS

Where multiple exposures occur to materials which act upon the same organ system, e.g., they are irritants, narcotic, hepatotoxic, etc., their combined effect, rather than that of either individually, should be considered as additive.
In these situations, the initial quantitative determination should be analyzed by adding the 80% upper confidence limits about the mean for the additive materials, and then identifying the sum as Category A, B, C or D by the standard criteria.; If the sum falls into Categories C or D, then additional monitoring should be conducted for each of the additive materials.
After the additional monitoring is conducted, the results should be analyzed by adding the 95% level of the Cumulative Frequency Distribution for each of the additive materials. The sum should then be compared to the standard criteria for determination of periodic monitoring frequency. Each of the additive materials should be monitored according to this frequency.

Examples:

Assume that for one JEP, both Allyl Chloride (AC) and Epichlorohydrin (ECH) are monitored. These materials have potentially additive toxic effects and; therefore, the combination of the exposures should be considered in the evaluation of industrial hygiene monitoring data, and in the determination of sampling strategy. The following cases represent examples of applying the standard criteria to the combination of exposures:

Case 1

The initial quantitative survey showed -

- The 80% UCL of mean for ECH < 0.1 SIS (Shell Internal Standard)

- The 80% UCL of mean for AC < 0.1 PEL

- Since the sum of the 80% UCLs does not clearly exceed 0.1 PEL, this would remain Category A with a reassessment in two years because of the Material Sampling Priority (I) of the two materials.

Case 2

The initial quantitative survey showed -

- The 80% UCL of mean for ECH < 0.1 SIS

- The 80% UCL of mean for AC = 0.4 PEL

- In this case, the sum of the 80% UCLs is between 0.4 and 0.5 PEL, placing the JEP in Category B. As a result, the initial quantitative survey should be repeated in one year.

Case 3

The initial quantitative survey showed -

- The 80% UCL of mean for ECH = 0.2 SIS

- The 80% UCL of mean for AC = 0.3 PEL

- In this case, the sum of the 80% UCLs is 0.5 PEL, placing the JEP in Category C. Additional samples should be collected for both ECH and AC. After 20 samples of each are obtained, assume the following results are obtained:

  95% cumulative frequency level for ECH = 0.4 SIS
  95% cumulative frequency level for AC = 0.4 PEL

  Since the sum of the 95% cumulative frequency levels is 0.8 PEL and the ~~two~~ Material Sampling Priority is I, the JEP should be periodically monitored two times per quarter for each material.

ATTACHMENT V

SUMMARY OF EXPOSURE MONITORING REQUIREMENTS IN OSHA HEALTH STANDARDS

MAY 7, 1985

Material	Standard	Initial Monitoring	Periodic Monitoring	
			> AL(1), < PEL(2)	> PEL
Asbestos	1910.1001	Performance Language	Not specified but less frequent than semiannually	At least semiannually
Vinyl Chloride	1910.1017	Performance Language	Repeat at least quarterly	Repeat at least monthly
Inorganic Arsensic	1910.1018	Performance Language	Repeat at least semiannually	Repeat at least quarterly
Lead	1910.1025	Performance Language	Repeat at least semiannually(3)	Repeat at least quarterly(3)
Coke Oven Emissions	1910.1029	Must monitor all jobs in regulated area	Must repeat monitoring quarterly for employees in regulated areas	
Cotton Dust	1910.1043	Performance Language	Repeat semiannually regardless of exposure level	
Dibromochloropropane	1910.1044	Performance Language	Repeat quarterly for each such employee	Repeat monthly for each such employee
Acrylonitrile	1910.1045	Performance Language	Repeat quarterly for each such employee	Repeat monthly for each such employee

Material	Standard	Initial Monitoring	Periodic Monitoring AL(1) PEL(2)	Periodic Monitoring PEL
Ethylene Oxide	1910.1047	Performance Language	Repeat semiannually for each such employee	Repeat quarterly for each such employee
1985 Proposed Benzene Std.	----	Performance Language	Repeat at least annually for each employee	Repeat semiannually for each such employee
1983 Proposed Ethylene Dibromide Std.	----	Performance Language	Repeat at least annually for each employee	Repeat semiannually for each such employee

Footnotes

(1) AL is Action Level

(2) PEL is Permissible Exposure Limit

(3) At least one sample for each shift for each job classification in each work area

ATTACHMENT VI

EXPOSURE MONITORING FOR MAINTENANCE TURNAROUNDS

General Information

In addition to monitoring normal operating periods and daily maintenance activities, exposure monitoring should be performed for unit turnarounds and other significant maintenance activities, e.g., tank cleaning, demolition involving asbestos, etc. Turnarounds represent a potential for employee exposure during the decontamination of process equipment, equipment opening, and unit start-up. Exposure monitoring during these activities on operators, pipefitters, boilermakers and others reflects how well the existing equipment and established procedures control exposure. After an initial evaluation, monitoring should be considered on subsequent shutdowns if there are changes in the procedures and/or to verify adequacy of work procedures. The frequency of monitoring turnarounds for verification of procedures will depend on the hazardous properties of the materials and the potential for exposure. The following table illustrates an example.

UNIT TURNAROUNDS[1]

Material Sampling Priority[2]	Representative exposure data been collected within 3 years?	Minimum frequency for conducting[3]	Extent of each survey	
			Bring Down[4]	Bring Up[5]
I	Yes	1X/3 turnarounds	X	
I	No	Alternate each turnaround	X	
II	Yes	Alternate each turnaround	X	X
II	No	Each turnaround	X	X
New or modified	N/A	Initial then select 1-4	N/A	X

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[1] Applies to major turnaround activity, not necessarily partial shutdowns
[2] See Attachment I
[3] Minimum time between monitoring turnarounds is three years
[4] Consider monitoring operators during the decontamination and purging of unit for the turnaround and both operators and maintenance during initial opening of process equipment. After process equipment has been opened, consider monitoring of craftsmen on a task basis, e.g., welding.
[5] Consider monitoring operators as unit starts up and returns to normal operation.

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