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16. Abstract (Limit: 200 words) This testimony presented before an OSHA Informal Public Hearing concerned the efforts of NIOSH to support OSHA's efforts to promulgate a new standard on air contaminants. Proposed exposure limits were questioned for some substances and the reasons for these questions were discussed for ethylene-glycol (107211), ethyl-ether (60297), and cresol (1319773) as examples of NIOSH's concern. NIOSH urged that additional chemicals be placed into the proposed rule and that Permissible Exposure Limits immediately be sought for several presently excluded. Additional chemicals which should be designated as potential occupational carcinogens were listed. Several workplaces established guidelines which were actually below the limits set in this proposed rule change. The need for OSHA to consider additional sources of information was discussed. Specific questions were addressed concerning the toxicity of C-5 to C-8 alkanes, the identification of special situations, alternative procedures for dealing with substances requiring special attention, what constitutes material impairment of health, and possible cost savings in the purchase of newer engineering controls.

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NIOSH Testimony to DOL

TESTIMONY OF THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH ON THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S PROPOSED RULE ON AIR CONTAMINANTS

29 CFR Part 1910
Docket No. H-020

Presented at the OSHA Informal Public Hearing
August 1, 1988
Washington, D.C.

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I am Richard A. Lemen, Director of the Division of Standards Development and Technology Transfer (DSDTT) of the National Institute for Occupational Safety and Health (NIOSH). With me today are senior staff from NIOSH research divisions, each of whom has expertise in various aspects of this rulemaking. Our purpose for appearing at this hearing is to support the Occupational Safety and Health Administration's (OSHA's) efforts to promulgate a new standard. NIOSH may make comments or recommendations in addition to those contained in this testimony, based upon other information presented during this hearing.

I want to take this opportunity to commend OSHA for embarking upon this rulemaking effort. This comprehensive updating of the Z-Tables will directly influence the health of all American workers. NIOSH strongly supports OSHA in its desire to make the air contaminant standards consistent with the most current information. We agree that there is an urgent need to update the current air contaminant standards because they represent exposure limits based on data available prior to 1968. Current information on health effects indicates that more protective limits are required for many substances. Even though NIOSH will question some of the specific Permissible Exposure Limits (PELs) that have been proposed, NIOSH does not question the wisdom of this rulemaking. Although NIOSH will suggest that some proposed PELs are not optimal, NIOSH nevertheless advocates adoption of more protective PELs. Even if some PELs are less protective than NIOSH might prefer, the overall impact of this Z-Table update represents a significant advance for worker safety and health. On the other hand, it should be clearly understood by all that this rulemaking is an exceptional event made necessary by the passage of 20 years without significant reevaluation of the standards contained in the Z-Tables. This should in no way impede vigorous action in the future to promulgate comprehensive standards as specified under Section 6(b) of the Occupational Safety and Health Act. Instead this should serve as an impetus to proceed more swiftly and efficiently with comprehensive standards.

NIOSH has transmitted to the Department of Labor 129 Criteria Documents and 50 Current Intelligence Bulletins (CIBs) (of these, one Criteria Document and one CIB were transmitted after this rulemaking was initiated). NIOSH Criteria Documents and CIBs are unparalleled in terms of the amount of information considered, the detail to which that information is examined, the extent to which evaluations are subjected to external peer review prior to publication, and the care with which those evaluations are explained in the published recommendation. It is important that the record is clear on what a NIOSH Criteria Document represents in this regard.

Criteria Documents are based on comprehensive reviews of the world's scientific literature. They routinely cite over 100 references and many cite several hundred. NIOSH does not rely upon information that

cannot be made public. Critical evaluations of cited references with detailed discussions of their implications are included in Criteria Documents to provide the reader with an appreciation of their strengths, their weaknesses, and a clear description of how NIOSH interprets these publications. By this method, the reader has enough information to reach independent conclusions regarding these cited reports. Each draft Criteria Document is reviewed by experts representing affected industries, organized labor, and trade or professional organizations, and by scientists, physicians, and other health professionals with related experience in academia, government, or industry. The number of these external peer reviewers normally is greater than 10 and often exceeds twice that number. In addition to the invaluable contribution their comments make to the completed Criteria Document, OSHA receives, along with the completed Criteria Document, the full text of each reviewer's written comments accompanied by itemized annotations indicating how the draft was modified in response, or providing the rationale if the comment or recommendation was not adopted. Each Criteria Document contains an extensive summary in which the basis for the Recommended Exposure Limit (REL) is carefully developed with clear and explicit citation of the data relied upon at all steps of the logical development. No other source of exposure limits approximates the comprehensiveness of these documents.

NIOSH recommends that the chemical universe defined for the present rulemaking include all chemicals covered by NIOSH RELs. We recognize the practical necessity for OSHA to limit the universe of chemicals subject to this rulemaking, but as noted by OSHA in its preamble, there are relatively "few instances" of substances with a NIOSH REL but no threshold limit value (TLV®). Including these substances would not significantly affect the "boundary on the number of substances to be evaluated," a concern expressed by OSHA in the notice for proposed rulemaking. NIOSH Table N5 (Appendix A) lists these 42 chemicals excluded up to now from the Z-Table update. If these are not added to the current update, they should be targeted for priority rulemaking to begin immediately upon completion of the present effort.

For a large number of the chemicals covered by this rulemaking (277 to be exact), NIOSH concurs with the PEL being proposed by OSHA. These chemicals are listed in NIOSH Table N1 (Appendix A). For them, the available documentation appears to support the proposed exposure limits as adequate to protect workers from recognized health hazards.

NIOSH questions the proposed PELs for the 31 chemicals listed in Table N2. They are:

1) Acrylic acid (HS 1009)
2) n-Butyl glycidyl ether (BGE) (HS 1052)
3) Camphor, synthetic (HS 1063)
4) Caprolactam vapor (HS 1065)

5) Coal dust (<5% quartz) (HS 1096)
6) Coal dust (>5% quartz) (HS 1097)
7) Disulfoton - skin (HS 1152)
8) Ethyl bromide (HS 1163)
9) Ethyl ether (HS 1164)
10) Ethylene glycol vapor (HS 1169)
11) Fenthion - skin (HS 1175)
12) Fluorine (HS 1179)
13) Formamide (NIC - skin) (HS 1182)
14) Furfural - skin (HS 1183)
15) Heptane (n-Heptane) (HS 1194)
16) Hexane isomers (HS 1201)
17) 2-Hexanone (Methyl n-butyl ketone) (HS 1202)
18) Isopropoxyethanol (HS 1223)
19) Isopropyl acetate (HS 1224)
20) Isopropylamine (HS 1228)
21) Manganese tetroxide (HS 1238)
22) Mesityl oxide (HS 1243)
23) Octane (HS 1296)
24) Ozone (HS 1301)
25) Pentane (HS 1306)
26) 2-Pentanone (methyl propyl ketone) (HS 1307)
27) Silica--Amorphous (diatomaceous earth) (HS 1352)
28) m-Toluidine - skin (HS 1401)
29) Triethylamine (HS 1408)
30) Vinyl acetate (HS 1424)
31) Zirconium compounds, as Zr (HS 1439)

Examples of reasons for NIOSH's concern for the chemicals from NIOSH Table N2 are given for the following 2 substances.

1. Ethylene Glycol (EG)

OSHA currently does not have a PEL and proposes a 50 ppm ceiling as the new PEL as recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). In the NIOSH review of EG, we have found that positive rat and mouse teratogenicity for oral administration of EG has been reported by Lamb et al. [1985], Price et al. [1985], and Hardin et al. [1987]. The summary statement by C. Price is germane to OSHA's consideration of PELs:

> "The lack of apparently serious maternal effects at the lowest dose which produced malformation in both species, as well as the severity and frequency of fetal defects at higher doses, suggest that EG may carry a selective risk to the embryo and should be considered a potential development hazard in situations where major EG exposure is likely to occur."

The interpretation of the human (volunteers) inhalation exposure study by Wills et al. [1974], as indicating a 50 ppm ceiling (125 mg/m^3) TLV, is questioned. Review of the reported study indicates the most common complaint was irritation of the upper respiratory tract during the 30-day, 20-22 hours per day exposures at mean daily concentrations ranging from 3 to 67 mg/m^3 (1.4-27 ppm) and the irritative phenomena became common when the concentration was raised to about 140 mg/m^3 (56 ppm). Despite the significantly erratic exposure concentrations during the 30 days of "continuous" exposure, the reported irritation would indicate that a 50 ppm limit does not offer sufficient protection from respiratory irritation. The potential teratogenicity and the known respiratory irritation at the proposed level suggests that OSHA should reconsider their proposed PEL.

In addition, the OSHA Summary of Toxicology should be corrected to read for the Wills et al. study [page 21035 of the Federal Register notice, 2nd column, 19 lines from the top]: "In a human inhalation study, Wills and colleagues [1974] reported that volunteers exposed to the aerosol from 20 to 22 hours per day for 4 weeks, at mean daily concentrations between 3 and 67 mg/m^3 (1.4-27 ppm) complained of throat irritation, and on occasion mild headache and lower back pain."

2. Ethyl Ether

OSHA proposes to add a short-term exposure limit (STEL) to their current PEL of 400 ppm for Ethyl Ether. The current PEL is the same as the ACGIH TLV and the STEL of 500 ppm is also recommended by ACGIH. ACGIH set a TLV of 400 ppm time-weighted average (TWA) and a 500 ppm STEL based upon workers developing a tolerance to irritation at that level [ACGIH 1986]. Nelson et al. [1943] tested human subjects for a period of 3 to 5 minutes for sensory responses to ethyl ether and reported, "Complaints of nasal irritation began at 200 ppm. Three hundred was objectionable as a working atmosphere." It was further suggested that 100 ppm was the highest concentration which the majority of subjects estimated satisfactory for 8-hour exposure and 200 ppm was a level which produced nasal irritation in a majority of subjects. Nelson stated that the study reported is "not sufficient" to act as a basis for new limits. However, it would appear that a 400 ppm TWA may protect workers from systemic effects, but would not prevent irritation to some individuals.

The concerns for the remaining 29 substances on NIOSH Table N2 have been submitted to the docket with NIOSH's written testimony.

Some of the chemicals in the universe defined by the 1986 ACGIH TLV list have been excluded from this rulemaking by OSHA for a variety of reasons. NIOSH concurs with OSHA's determination on 127 substances

listed in NIOSH Table N3A (Appendix A) as not needing further revisions based on available data, but believes that those listed in NIOSH Table N3B (Appendix A) should be included in this rulemaking. NIOSH has identified 9 chemicals in NIOSH Table N3B which are of concern. They are:

1) Acetylene tetrabromide (HS None)
2) Chlorobenzene (HS None)
3) Chromium (II) compounds, as Cr (insoluble) (HS None)
4) Chromium (III) compounds, as Cr (insoluble) (HS None)
5) Cresol, all isomers - skin (HS None)
6) Manganese dust & compounds (HS None)
7) Molybdenum, as Mo (soluble compounds) (HS None)
8) Nitromethane (HS None)
9) Parathion - skin (HS None)

Cresol will serve as an example of NIOSH's concern. The OSHA PEL and the ACGIH TLV [ACGIH 1986] for cresol both have identical exposure limits of 5 ppm (22 mg/m^3), TWA, with a skin notation; therefore, this chemical is not being considered for revision. However, NIOSH has established an REL of 2.3 ppm (10 mg/m^3), TWA, which should be considered in the revision of the OSHA standards. In 1952, ACGIH established a 5 ppm TWA based on an analogy with phenol [ACGIH 1986]. The toxicity of cresol compared to phenol was considered in two studies [Fairhall 1957; Hamilton et al. 1949]. It was believed the 5 ppm level would protect against irritation, and kidney and liver damage.

NIOSH [1978] established an REL of 2.3 ppm (TWA). NIOSH reported that although the data indicates similarities in toxicity between cresol and phenol when they are given by several routes of exposure, other evidence suggests that cresol is more toxic by inhalation [Uzhdavini et al. 1972]. The findings of Deichmann et al. [1963] agreed with Uzhdavini concerning the adverse effects of cresol below 20 mg/m^3. The NIOSH REL is more protective than the current OSHA PEL or TLV.

NIOSH's concerns for the other 8 substances are attached to our written comments and are in the OSHA docket.

In NIOSH Table N4 (Appendix A), NIOSH has identified 48 substances which OSHA is proposing to regulate as nuisance dusts. OSHA is proposing PELs for 47 substances (Table C10-1) that are currently regulated by OSHA's PEL for nuisance dust (15 mg/m^3 for total dust and 5 mg/m^3 for respirable dust). The proposed PELs are 5 mg/m^3 for fibrous glass dust and 10 mg/m^3 for the remaining 46 substances. The 10-mg/m^3 PELs are based on the TLVs established for these substances by ACGIH. Exposure to these substances is considered to cause adverse "nuisance" effects, including interference with vision, irritation of the upper respiratory tract and skin, and deposits of these substances in the eyes, ears, and nasal passages. Reactions of lung tissue to these substances are considered to be reversible when exposure ceases.

NIOSH has conducted a limited evaluation of the literature on the 48 substances in Table N4, and has concluded that the documentation cited by OSHA is inadequate to support the proposed PEL of 10 mg/m^3 for many of the substances. Recent toxicologic and exposure data indicate that exposure to some of these substances may cause cancer or other serious adverse health effects. Adherence to the proposed PEL of 10 mg/m^3 (total dust) would not prevent the toxicologic effects associated with many of these substances. NIOSH is therefore concerned that it is misleading to apply the term "nuisance dust" to such substances.

NIOSH is also concerned that total dust exposure may be an inappropriate criterion for assessing the relationship between exposure and effect. The 48 substances considered here are present in many occupational environments within a respirable size range, and the respiratory system is therefore the most likely route of exposure. However, differences in particle morphology and size affect pulmonary defense mechanisms differently. Furthermore, solubility and pH must be determined to assess the effects of some substances on the mucous membranes. All of the characteristics of a substance need to be assessed when determining its potential toxicity. For substances that typically become airborne in the workplace as respirable particulates, a PEL based on the respirable fraction of the substance would be warranted. Substances that exhibit a toxic effect upon contact with mucous membranes may more appropriately require exposure limits for both total and respirable particulates.

NIOSH is further concerned that exposure to several of the substances listed in Table C10-1 may involve concomitant exposure to free silica, which may cause silicosis or lung cancer. OSHA has proposed that the PEL for these substances be applied only when the quartz content is less than 1 percent. This criterion may understate the risk of airborne exposure to quartz, since the percentage of quartz is typically determined by analysis of the raw material or of the settled dust and not by analysis of airborne samples. Airborne samples should be collected and analyzed for free silica whenever workers are exposed to quartz or to any of the substances associated with free silica. Exposure to free silica should be limited to concentrations below the NIOSH REL of 50 ug/m^3.

NIOSH is particularly concerned that toxicologic evidence demonstrates a relationship between exposure to certain substances listed in Table C10-1 and chronic respiratory disease, including cancer. Clear evidence of chronic respiratory disease has been observed in workers exposed to various types of mineral fibers [Walton 1987]. Enterline et al. [1987] reported a statistically significant risk of lung cancer in workers exposed to glass and mineral-wool fibers. This risk of cancer was also observed in animals [Stanton et al. 1980] when fibers with various physical and chemical characteristics were implanted in the pleurae of rats. The ability of these fibers to induce cancer was

discovered to be related to the length and diameter of the fibers and not to their chemical compositions. Rats dosed with fibrous glass, aluminum oxide, and silicon carbide exhibited a carcinogenic response similar to that of rats dosed with asbestos.

The NIOSH evaluation of data on titanium dioxide indicates a risk of cancer from exposure. The incidence of tumors observed in animals exposed to titanium dioxide meets the OSHA criterion for potential occupational carcinogens (29 CFR 1990.103). Other data evaluated by NIOSH indicate that benomyl exposure may cause adverse reproductive effects and that magnesium oxide exposure may cause chronic respiratory disease. NIOSH has included pertinent literature on these substances as part of its submission, and OSHA should consider it in this rulemaking.

Having selected the TLV list as the universe to be considered, OSHA frequently limits its consideration of health effects to those that the ACGIH considered when establishing the TLV. The full range of available toxicologic, epidemiologic, and exposure information should be considered for all chemicals in the universe selected. The need to do so is most evident for chemicals that NIOSH and others consider to be carcinogenic. For a large number of these chemicals, OSHA proposes to establish a PEL without identifying the chemical as a potential occupational carcinogen. In some cases, OSHA acknowledges without comment the conclusion by NIOSH or others that these chemicals are potential occupational carcinogens, but still does not so designate those chemicals. In some cases the limits proposed for adoption were based on carcinogenicity; in other cases they were based on other acute or chronic health effects. Even if OSHA chooses not to accept NIOSH recommendations that occupational exposure to carcinogens should be restricted to the lowest feasible level, OSHA should designate these chemicals as potential occupational carcinogens because these chemicals meet the criteria for carcinogenicity as established by OSHA [29 CFR 1990.103]. Chemicals that should be designated as potential occupational carcinogens are listed in NIOSH Tables N6A and N6B (Appendix A) and have been submitted to the OSHA docket with our written testimony. On Table N6A, NIOSH has identified 39 substances which have proposed PELs that NIOSH can agree with, but for which a carcinogen designation should be added to the PEL. The chemicals are:

1) Acrylamide - skin (HS 1008)
2) Aldrin - skin (HS None)
3) Amitrole (HS 1020)
4) Aniline & homologues - skin (HS 1025)
5) Anisidine (o-, p-isomers) - skin (HS None)
6) Captafol - skin (HS 1066)
7) Captan (HS 1067)
8) Carbon tetrachloride - skin (HS 1073)
9) Chlordane - skin (HS None)
10) Chloroform (HS 1086)

11) Dichloroacetylene (HS 1123)
12) Dichloroethyl ether - skin (HS 1127)
13) Dichloropropene - skin (HS 1129)
14) Dieldrin - skin (HS None)
15) Diglycidyl ether (DGE) (HS 1139)
16) Dimethyl sulfate - skin (HS 1142)
17) Dinitrotoluene - skin (HS None)
18) Dioxane - skin (HS 1145)
19) Di-sec-octyl phthalate (HS 1116)
20) Ethylene dichloride (HS 1168)
21) Heptachlor - skin (HS None)
22) Hexachlorobutadiene - skin (HS 1195)
23) Hexachloroethane - skin (HS 1197)
24) Hexamethyl phosphoramide (HS None)
25) Methyl iodide - skin (HS 1259)
26) Nickel carbonyl (as Ni) (HS 1284)
27) Propylene imine - skin (HS None)
28) Silica - crystalline (cristobalite) (HS 1354)
29) Silica - crystalline (tridymite) (HS 1356)
30) 1,1,2,2-Tetrachloroethane - skin (HS 1385)
31) Toluene-2,4-diisocyanate (TDI) (HS 1398)
32) o-Toluidine - skin (HS 1399)
33) 1,1,2-Trichloroethane (HS None)
34) Trichloroethylene (HS 1406)
35) 1,2,3-Trichloropropane - skin (HS 1407)
36) Uranium (insoluble compounds, as U) (HS 1418)
37) Uranium (soluble compounds, as U) (HS 1419)
38) Vinyl cyclohexene dioxide (HS 1426)
39) Wood dust (hard wood) (HS 1430A)

There are 53 chemicals on NIOSH Table N6B that not only should be designated as carcinogens, but for which there remains a substantial level of risk at the proposed PEL. The substances are:

1) Acetaldehyde (HS 1001)
2) Arsine (HS None)
3) Asphalt (petroleum) fumes (HS 1028)
4) Benzo(a)pyrene (HS None)
5) Beryllium & compounds, as Be (HS 1033)
6) tert-Butyl chromate, as CrO3 - skin (HS None)
7) Carbon black (HS None)
8) Chlorinated camphene - skin (HS 1078)
9) Chlorodiphenyl (42% chlorine) - skin (HS None)
10) Chlorodiphenyl (54% chlorine) - skin (HS None)
11) Chromic acid and chromates (HS 1092)
12) Chromite ore processing (chromates), as Cr (HS None)
13) Chromium (VI) compounds, Cr (water soluble) (HS None)
14) Chromium (VI) compounds, Cr (certain water insoluble) (HS None)
15) Chromyl chloride (HS 1094)
16) Chrysene (HS None)

17) Coal tar pitch volatiles, as benzene solubles (HS None)
18) DDT (Dichlorodiphenyl-trichloroethane) (HS 1113)
19) p-Dichlorobenzene (HS 1125)
20) Dimethyl carbamoyl chloride (HS None)
21) 1,1-Dimethylhydrazine - skin (HS None)
22) Epichlorohydrin - skin (HS 1158)
23) Ethyl acrylate - skin (HS 1161)
24) Ethyl chloride (HS None)
25) Gasoline (HS 1185)
26) Hydrazine - skin (HS 1205)
27) Lead chromate (as Cr) (HS None)
28) Methyl bromide - skin (HS 1253)
29) Methyl chloride (HS 1254)
30) Methyl hydrazine - skin (HS None)
31) 4,4'Methylene bis(2-chloroaniline) - skin (HS 1273)
32) Nickel (soluble [or inorganic] compounds as Ni) (HS 1283)
33) Nickel sulfide roasting, fume & dust (as Ni) (HS None)
34) p-Nitrochlorobenzene (HS 1288)
35) 2-Nitropropane (HS 1291)
36) Perchloroethylene (HS 1308)
37) N-Phenyl-beta-naphthylamine (HS None)
38) Phenyl glycidyl ether (PGE) (HS 1315)
39) Phenylhydrazine - skin (HS 1317)
40) Propane sultone (HS None)
41) Propylene dichloride (HS 1341)
42) Propylene oxide (HS 1344)
43) Rosin core solder pyrolysis products, as formaldehyde (HS 1350)
44) Silica--Crystalline (quartz) (HS 1355)
45) Silica--Crystalline (tripoli) (HS 1357)
46) Silica--Crystalline (fused) (HS 1358)
47) o-Tolidine - skin (HS None)
48) p-Toluidine - skin (HS 1400)
49) Vinyl bromide (HS 1425)
50) Vinylidene chloride (HS 1428)
51) Welding fumes (HS 1430)
52) Wood Dust (soft wood) (HS 1430b)
53) Zinc chromate, as Cr (HS 1436)

Some chemicals on NIOSH Tables N6A and N6B have been excluded from this rulemaking by OSHA as is evident from their lack of a HS number. However, NIOSH concludes that OSHA should include these chemicals in this rulemaking.

On NIOSH Table N7, NIOSH has identified 15 substances for which OSHA intends to adopt a TWA instead of the recommended NIOSH Ceiling Value. NIOSH recommends that OSHA adopt the NIOSH Ceiling Values to provide the most appropriate degree of health protection. These substances are:

1) Butyl mercaptan (HS 1054)
2) Benzyl chloride (HS None)
3) Cyanides (as CN) - skin (potassium cyanide) (HS None)
4) Cyanides (as CN) - skin (sodium cyanide) (HS None)
5) Hydrogen sulfide (HS 1209)
6) Hydroquinone (HS None)
7) Isopropyl glycidyl ether (IGE) (HS 1227)
8) Methyl chloroform (HS 1255)
9) Methyl mercaptan (HS 1263)
10) Petroleum distillates (naphtha; rubber solvent) (HS 1312)
11) Phenol - skin (HS None)
12) Phenyl mercaptan (HS 1316)
13) Phosgene (HS None)
14) Vanadium (as V205) - respirable dust fume (HS 1421)
15) Vanadium (as V205) - fume (HS 1422)

Turning now to the specific questions posed in the NPRM:

1. **Are substances included which should be excluded from this rulemaking?**

   No. On the contrary, substances were excluded which should have been included. Immediately upon completion of this rulemaking, OSHA should take action to establish PELs for all substances that are excluded from this rulemaking despite the existence of a formal NIOSH recommendation to OSHA. As a first step, OSHA should initiate consolidated rulemaking similar to the present Z-Table update to adopt all NIOSH RELs pending chemical-specific Section 6(b) rulemaking to establish comprehensive standards.

2. **Is additional health and feasibility documentation available relative to the proposed PELs beyond that described in the preamble?**

   Yes. OSHA has frequently limited itself to the documentation used by the ACGIH in support of TLVs. Whenever available, NIOSH Criteria Documents, Current Intelligence Bulletins, and Alerts should be considered by OSHA in its final rulemaking. For many of the chemicals, substantial databases are available from other governments (e.g., Germany, the United Kingdom, Sweden), as well as from organizations such as the International Labor Organization, the American Industrial Hygiene Association, the Nordic Expert Group for Documentation of Occupational Exposure Limits, and the National Library of Medicine. A large number of National Cancer Institute (NCI), National Toxicology Program (NTP), and International Research on Cancer (IARC) monographs on chronic bioassay reports are available that provide extensive information on acute and chronic systemic toxicity in addition to data on potential carcinogenicity.

As part of this response, NIOSH is providing a chemical-by-chemical discussion with citations of the most pertinent supporting data that could be identified within the time limitations. For chemicals included in the PEL update, copies have been submitted to the docket of all pertinent NIOSH Health Hazard Evaluations (HHEs), as well as all citations for toxicity contained in the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS). These data are collected as mandated by Section 20(a)(6) of the Occupational Safety and Health Act of 1970 (PL 91-596). These data are publicly available and will assist OSHA in fulfilling its obligation under the Occupational Safety and Health Act to consider "the latest available scientific data in the field." NIOSH has not attempted to provide OSHA with the other elements the Act requires OSHA to consider, namely, "...the feasibility of the standards, and experience gained under this and other health and safety laws." The HHE reports will provide some idea of the exposures found during requested NIOSH evaluations in industry. NIOSH is continuing to develop information and will provide to OSHA other relevant data on exposure concentrations found in industry in our post-hearing comments. These data should assist OSHA in determining feasibility.

In addition to these publicly available sources of information, OSHA should ask major employers throughout the country to provide listings of all of their own internal exposure limits along with their documentation of those limits. In many industries these may be more restrictive than existing OSHA PELs, and this should be an excellent source of information on feasibility of various limits.

Because many of the proposed PELs are derived from TLVs, OSHA should obtain from the ACGIH all unpublished data that contributed to the establishment of those TLVs. OSHA should follow up on these unpublished data to make the record as complete as possible.

Dimethyl Formamide (DMF), a compound from NIOSH Table N3A, is of particular interest to both NIOSH and OSHA because of recent published information concerning testicular cancer and liver disease. NIOSH will provide to OSHA a summary of these data presently in preparation.

3. **Are substances included in this rulemaking used in industries other than those described in the preamble?**

and

4. **Are substances included in this rulemaking used for purposes other than those described in the preamble?**

NIOSH has previously supplied to OSHA, at their request, a printout of the complete NIOSHTIC data base file on approximately 260 chemicals to aid in the identification of additional industries using the chemicals in this rulemaking. NIOSH is continuing to search its data base files (National Occupational Hazard Survey [NOHS]) for additional information which will be provided during this rulemaking process.

5. **Do alternative unpublished exposure guidelines exist, such as those used in private workplaces, which may be suitable for general usage?**

NIOSH is aware of the existence of internal exposure guidelines in a number of private workplaces. NIOSH surveyors, in assessing ethylene oxide exposure, often found internal workplace controls in the 1 to 2 ppm range when the OSHA PEL was 10 ppm. Some of the proposals for change by ACGIH incorporate workplace exposure limits being used in industry at the time of the change. Nickel carbonyl is an example. This documentation relates that a nickel refinery in Sudbury, Canada, begins treating their workers for nickel carbonyl poisoning when their blood level of nickel reaches 150 micrograms/liter. It is further noted that the factory sounds an alarm when air concentrations read 10 ppb and an evacuation alarm sounds at 80 ppb. In this case the TLV is 5 times the level thought to be safe.

There are existing guidelines on exposure to radioactive materials published by the International Commission on Radiation Protection (ICRP) and by the National Commission on Radiation Protection, which are applicable to radioactive substances, specifically, soluble and insoluble uranium in this rulemaking.

Before considering unpublished data, OSHA should update the published information on which it is relying for this proposed rule. A cursory review indicates that 72% of the references cited by OSHA were published prior to 1980 and 35% prior to 1969. The latter is the publication date for the current Z-1 table. NIOSH has submitted a complete set of references for each of the substances under consideration from its RTECS data base.

6. **Is there information regarding laboratory analytical procedures which may be used in lieu of those suggested by OSHA (see Appendix A) to determine exposure to air contaminants?**

NIOSH has transmitted to OSHA all of its applicable analytical procedures. NIOSH would caution OSHA that, in the "Sampling and Analytical Methods" table, several existing NIOSH analytical methods have been extended to compounds for which the suggested method has not been verified. Some of these compounds have

markedly different chemical properties than the compound(s) for which the method was developed. These methods will require validation before use:

Method	Validated for	Extension proposed by OSHA	HS #
NIOSH 1003	halogenated H/C	1,3-dichloropropene	1129
NIOSH S43	methyl methacrylate	2-hydroxylpropyl acrylate	1211
NIOSH 1400	isopropanol	propargyl alcohol	1335
NIOSH 1400	isopropanol	isooctyl alcohol	1220
NIOSH 1603	acetic acid	trichloroacetic acid	1404
NIOSH 1003	halogenated H/C	dichloroacetylene	1123
NIOSH 1020	1,1,2-trichloro-1,2,2-trifluoroethane	chlorodifluoromethane	1085
NIOSH 1020	1,1,2-trichloro-1,2,2-trifluoroethane	chloropentafluoroethane	1087
NIOSH 1003	halogenated hydrocarbons	o-chlorostyrene	1089
NIOSH 1003	halogenated hydrocarbons	o-chlorotoluene	1090
NIOSH 1500	hydrocarbons	cyclopentane	1111
NIOSH 1500	hydrocarbons	hexane isomers	1201
NIOSH 5021	terphenyls	hydrogenated terphenyls	1210
NIOSH 2002	aromatic amines	N-isopropylaniline	1229
NIOSH S264	ethyl silicate	methyl silicate	1266
NIOSH 1500	hydrocarbons	nonane	1293
NIOSH 2002	aromatic amines	p-toluidine	1400
NIOSH 2002	aromatic amines	m-toluidine	1401

The following are corrections to the NIOSH Analytical Methods for PEL Update Table (pp. 21308-21312 of the Federal Register).

No.	Analyte	Correct NIOSH Validated Method
4	acetone	NIOSH 1300
17	ammonia	Add NIOSH S347
20	ammonium sulfamate	NIOSH S348
63	carbon Dioxide	NIOSH S249
190	hexachlorocyclopentadiene	NIOSH 2518
304	petroleum distillates (naphtha)	NIOSH 1550
392	1,2,3-trichloropropane	NIOSH 1003

7. **Are the proposed exposure limits for each substance appropriate?**

NIOSH has addressed comments on each exposure limit it believes to be inappropriate, and has submitted these comments with supporting data to the docket as specified by OSHA in part VIII of the proposed rule.

8. Is additional information available for those substances for which ACGIH proposed a higher TLV which might affect OSHA's decision that such a change was not justified?

This rulemaking is not an appropriate proceeding for raising any permissible exposure limit. The decision to raise an occupational exposure limit should only be made through a full 6(b) rulemaking procedure with adequate time for all concerned parties to respond.

NIOSH has examined all of the available additional scientific information on substances for which the ACGIH TLV is higher and has commented where appropriate. The only substance included on Table C16-1 (Federal Register, p. 21211) that OSHA proposes to raise is Fluorine (HS 1179), and NIOSH has submitted detailed comments on this chemical which demonstrate that OSHA was not justified in raising the proposed PEL.

Additionally, OSHA inadvertently stated (on p. 21029 of the Federal Register) that the current OSHA PEL for Synthetic Camphor (HS 1063) is 2 ppm rather than 2 mg/m^3 (0.3 ppm). Because of this error, OSHA proposed to adopt the ACGIH TLV and STEL, i.e. 2 and 3 ppm, respectively, which is approximately 7 times higher than the current PEL.

9. **Should the implementation dates for some substances be delayed because of sampling/analytical limitations or short-term feasibility impact considerations?**

Delaying the implementation date would not be technology forcing with regard to reducing occupational exposures. However, it is extremely important to note that for many substances listed in the update, there are no sampling and analytical methods available or the method given has not been validated by either NIOSH or OSHA. Also, many of the proposed methods are in-house OSHA methods which are not available to NIOSH or the general public for evaluation. Finally, there are methods whose Limit of Quantitation cannot support the proposed PEL or STEL. These problems are critical and must be corrected for proper enforcement of the regulation.

Therefore, it is important that NIOSH and OSHA work together on a method development scheme that will allow the appropriate validated methods to be developed in a prioritized fashion within the implementation of the regulation. Also, it is imperative that OSHA set a high priority for promulgating followup regulations that deal with these sampling and analytical issues.

10. **Is there additional information relative to the OSHA plans to adopt some recommended 10-hour TWA REL's as an 8-hour PEL?**

A NIOSH REL "... determined as a time-weighted average (TWA) exposure for up to a 10-hour work day, 40-hour work week" first appeared in the 1973 Inorganic Arsenic Criteria Document. That document was developed during the energy crisis of the early 1970's, when many employers began using 10-hour work days as an energy conservation measure. Consideration was given to recommending a mathematical adjustment of TWA RELs based on a constant limitation of the Concentration x Time for 8-hour and longer work days. For example, an 8-hour TWA of 100 ppm (100 ppm x 8 hr = 800 ppm hr) would convert to 80 ppm for a 10-hour day (800 ppm hr/10 hr = 80 ppm hr). The conclusion at the time was that, so long as the work schedule did not exceed 10 hours per day or 40 hours per week, there was not sufficient precision in the selection of exposure limits to justify the precision implied by that mathematical adjustment. Therefore, the same TWA REL was intended to be applied to 8-hour and 10-hour work days in a 40-hour work week. The action proposed by OSHA in this rulemaking relative to these RELs is consistent with that original intent. A mathematical conversion in the opposite direction, i.e., converting a 10-hour TWA of 100 ppm (1000 ppm hr) to an 8-hour TWA of 125 ppm (1000 ppm hr), would be contrary to the original intent and would be opposed by NIOSH.

11. **Does the most current scientific information generally support acceptance of the hypothesis that all C-5-8-Alkanes are not equally toxic because a metabolite of n-Hexane exhibits unique neurotoxic properties?**

It is generally accepted that the metabolite that is responsible for the neurotoxic effects of n-hexane is 2,5-hexanedione (2,5-HD), a gamma diketone. This compound is also a metabolite of methyl-n-butyl ketone (MnBK), but is not known to be a metabolite of other alkanes in the C-5 to C-8 group. 2,5-HD produces axonal degeneration (so-called "central peripheral distal axonopathy") characterized by a breakdown of neurofilaments and their accumulation distal to Ranvier nodes in the neuron. The observable symptomatology is, in sequence, limb weakness, severe paralysis, and muscle degeneration. The observation of similar neuropathies after exposures to MnBK or n-hexane and the discovery of their common metabolite, 2,5-HD, suggested the specific hypothesis that it is the gamma spacing of the diketone in the molecule that is the necessary and sufficient characteristic for producing this type of neuropathy. It would be correct to state that 2,5-HD is the principal neurotoxic metabolite of n-hexane and MnBk. It should also be recognized that any gamma diketone or any compound that may be metabolized to a gamma diketone (e.g., 5-nonanone metabolized to

2,5-nonanedione) may be neurotoxic. It would be incorrect to conclude that the neurotoxic properties ascribed to n-hexane are unique to this compound. Other alkanes or related chemicals that are ultimately metabolized to a gamma diketone may have similar toxicity.

12. **OSHA has proposed to use exposure limits from two well-established sets of guidelines as a source of values to update the PELs. Is information available about alternative sources which OSHA might consider for this purpose?**

In its preamble to this proposed rulemaking, OSHA referred to 9 alternative sources:

International Labor Organization
World Health Organization
European Economic Community
United Kingdom Occupational Exposure Limits
West German Maximum Allowable Concentrations
Swedish Allowable Workplace Air Concentrations
Japanese Permissible Exposure Limits
American National Standards Institute
American Industrial Hygiene Association

Another possibility is the Nordic Expert Group for Documentation of Occupational Exposure Limits.

NIOSH believes all of these should be considered as equal or superior to the ACGIH TLV list in terms of the the criteria listed by OSHA.

No single source should be expected to stand alone as a comprehensive list of candidates for regulation. OSHA should construct its own comprehensive list by drawing information from all available sources.

No single list is current in its entirety. Although the ACGIH TLV list is republished annually, it is a mistake to assume that every TLV is reconsidered annually. The annual republishing is only a mechanism whereby those TLVs that have been revised can be disseminated. The ACGIH does not claim to reevaluate every TLV on a regular schedule.

Economic and technical feasibility may be considered by the ACGIH in developing TLVs, but those considerations, if any, are not defined in the documentation of TLVs. Feasibility information for PELs derived from agencies listed above would be comparable, in most cases, to that provided by the ACGIH in support of TLVs.

OSHA should consider the availability and quality of documentation on a substance-by-substance basis and use all available documentation, rather than select an exclusive list of substances simply because that list consistently has some documentation.

The fact that the alternative sources listed above do not originate in the U.S. should not disqualify them from consideration of applicability. They should be judged against what is required to protect workers from the known toxicity of each substance regulated. Only after determining the level of control necessary to ensure a safe and healthy workplace should other factors be considered. Because they are limits that other officials have judged necessary to protect worker safety and health, NIOSH believes that OSHA should at least consider limits from all of the sources listed above.

13. **OSHA has outlined its criteria for identifying special situations. Are alternative criteria available which might be used in lieu of these, or in addition to them?**

OSHA has identified five circumstances that it considers special situations:

Situations one and two involve a comparison of the ACGIH TLVs to four alternate data bases--the United Kingdom 1987 Occupational Exposure Limits, the West German 1985 Maximum Allowable Concentrations, the Japanese 1983 Permissible Exposure Limits, and the Swedish 1984 Allowable Workplace Air Concentrations. OSHA Tables 1-F-C and 1-F-D, that are based on these comparisons, are not accurate. NIOSH has reviewed the pertinent data on selected substances on Tables 1-F-C and 1-F-D and has submitted comments on the appropriateness of the limits proposed.

Situation three involves the substances where the current TLV exceeds the existing PEL. NIOSH has addressed this issue in the response to question 8.

Situation four involves the circumstances where the available analytical methods are not adequate to measure the substance at the air concentration proposed. NIOSH has addressed this situation in the answer to question 9.

In the fifth situation where recent information suggests that neither the TLV nor the REL is appropriate, NIOSH finds it difficult to identify the exact substances to which OSHA is referring. NIOSH has commented on those substances which, based on the best available scientific information, meet OSHA's occupational carcinogen definition. On other substances where recent information indicates that neither the TLV nor the REL is

low enough to be adequately protective. OSHA should adopt the lower of the available limits and immediately schedule the substance for expedited rulemaking.

14. **OSHA has outlined three alternative procedures for dealing with substances requiring special attention. Are additional approaches available which might be used in lieu of these, or in addition to them?**

NIOSH would support OSHA in its decision to adopt either the level proposed or such other level as the evidence presented to the record indicates as proper for these substances, and identify them as possibly requiring followup rulemaking. NIOSH has endeavored to provide OSHA with the required data for selecting a proper limit for selected substances on Tables I-F-C and I-F-D. NIOSH concurs with OSHA that it is in the best interest of the worker to promptly provide such increased health protection as is indicated by the evidence in the record.

15. **OSHA has performed feasibility analysis for the following substances, based on limited available information: Acetonitrile, Carbon disulfide, Carbon monoxide, Carbon tetrachloride, Chloroform, Ethylene dichloride, Ethylene glycol dinitrate, Fibrous glass dust, Hydrogen cyanide, Isophorone diisocyanate, Nitrogen dioxide, Nitroglycerin, Trichloroethylene.**

Is further information available which might be used to supplement the present findings regarding the feasibility of achieving these levels in the workplaces?

From NIOSH research data, we are including a detailed engineering feasibility study (Appendix B) for those listed in the question, as well as for the following chemicals: Acetone, Chlorine, Styrene, and Sulfur dioxide.

16. **OSHA has made a preliminary assessment of the proposed rulemakings' impact on large and small establishments. The Act requires OSHA to determine whether a regulation will have a significant impact on a substantial number of small entities, pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. 601 et seq. Is there additional information regarding implementation of this rule for small businesses and entities which OSHA should consider?**

NIOSH has no comment.

17. **OSHA has proposed PEL's for some substances where the basis of this proposal also includes a carcinogenicity designation (e.g., TLV with an A1 or A2 designation; REL with a Ca designation). Should OSHA include a similar carcinogen designation in the Z-4 Table in this rulemaking?**

Yes. For both the TLVs and the RELs, the carcinogen designation is an inseparable part of the recommendation. OSHA should include carcinogen designations for all chemicals that meet the OSHA definition of "potential occupational carcinogen" (29 CFR 1990.103).

18. **OSHA has preliminarily decided that for substances where the ACGIH TLV is a TWA and the NIOSH REL is a Ceiling Value which is the same or one half of the TWA, OSHA will propose that the TWA be adopted as the PEL. Should this approach be modified in the final rulemaking? What approach should be used when the converse of this situation (TLV, Ceiling REL, TWA) exists?**

NIOSH would suggest that this question fails to recognize the essential differences between a time weighted average (TWA) and a Ceiling Value. A TWA is appropriate as a limit when the toxic effect of the substance is directly related to the total dose received in a daily exposure. Ceiling values are intended to minimize toxic effects related to the peak exposure.

Ceiling values are necessary when there are immediate acute responses to an air contaminant independent of the total daily dose or when chronic effects are dose-rate response related. In conjunction with a TWA, ceiling values are also used to minimize the total daily dose when there is intermittent occupational exposure, e.g., ethylene oxide.

The simple numerical relationship that OSHA has proposed is not a scientifically sound basis for selecting between a TWA and a ceiling value. An analysis of the data supporting the proposed limit must be conducted on a case-by-case basis to discern which limit is appropriate.

NIOSH has submitted specific comments on a substance-by-substance basis in this category to assist OSHA in selecting the appropriate limit. These substances are listed in the NIOSH Table N7 of the NIOSH comments.

19. **OSHA preliminarily plans to adopt a phased start-up schedule. This would include an initial start-up requirement permitting the use of alternate control methods for revised PEL's, followed at a later date by the required use of control methods fully consistent with the methods of compliance priorities in effect at that time. OSHA will shortly be requesting comments on the hierarchy of controls. An alternate approach is to set a compliance date for engineering controls based on final determinations of that rulemaking. OSHA solicits comments on those approaches and suggestions regarding appropriate times for the two proposed start-up dates.**

NIOSH believes that work practices and engineering controls such as substitution, isolation, and ventilation should be used to control occupational exposures to the fullest extent feasible. NIOSH believes that personal protective equipment should be worn only when engineering controls are not feasible, such as during maintenance procedures.

NIOSH recommends that OSHA allow industry 6 months to come into compliance by any combination of control methods, and 2 years for compliance by the NIOSH recommended hierarchy of control methods [NIOSH 1983]. OSHA currently is recommending that industry be allowed 4 years to come into compliance by OSHA's hierarchy of control methods. Furthermore, NIOSH recommends that OSHA require staged implementation over the 2-year period of conversion to the hierarchy. This latter requirement would be technology forcing and it would minimize the occurrence of last minute requests to OSHA for variances to meet the conversion requirement.

20. **OSHA requests comment on whether the establishment of margins of safety below lowest observed or no effect levels is consistent with the concept of "significant risk," and on whether the specific margins of safety proposed for specific chemicals are appropriate.**

Margins of safety and safety factors are attempts to adjust for uncertainty in available data and knowledge. The use of a margin of safety or a safety factor approach to identify exposure limits does not estimate the human risk associated with those proposed exposure limits. Therefore, such an approach cannot be considered to provide protection against or to reduce "significant risk" (either in a general conceptual sense or in the sense of any specific judicial precedent). Nonetheless, NIOSH recognizes that a thorough case-by-case evaluation for all major industrial agents may not be possible for a variety of reasons, and the use of a margin of safety or a safety factor approach to identify exposure limits for those chemicals provide a pragmatic method to develop standards. The exception to this statement is that NIOSH does not believe such an approach should be used to identify an exposure limit for an adverse health effect that results from non-threshold processes (e.g., cancer).

In developing its recommendations to OSHA, NIOSH conducts thorough evaluations of all research data, estimated human risks associated with specific exposures, the sensitivity of measurement and analytic methods, alternative technologies, technological feasibility of various exposure levels, background or ambient exposure levels, methods of worker protection, and many other factors pertinent to specific exposure agents or environments. NIOSH knows of no other method to develop reliable exposure limit standards that is consistent with NIOSH's

responsibility from the OSHAct to assure as far as possible, every working man and woman in the Nation, safe and healthful working conditions. Since the use of a margin of safety or a safety factor approach does not address essential issues required to develop a reliable exposure limit, including evaluation of "significant risk," NIOSH recommends that any standards developed by the use of a margin of safety or a safety factor approach be considered interim standards. NIOSH recommends that standards based on a margin of safety or a safety factor approach, as well as standards derived from a case-by-case evaluation, be periodically reviewed to determine what new information is available.

NIOSH is not recommending specific margins of safety or safety factors on any chemical.

21. **OSHA has identified sensory irritation, which causes rhinitis, cough, sputum production, chest pain, wheezing and dyspnea as material impairment of health. OSHA invites comments on this understanding.**

The recognition of sensory irritation as potentially being "material impairment of health" is consistent with the current scientific consensus related to health effects of environmental agents.

Mucous membrane irritants can cause increased blink frequency and tearing; nasal discharge, congestion, and sneezing; and cough, sputum production, chest discomfort, wheezing, chest tightness, and dyspnea. Work environments often require levels of physical and mental performance considerably greater than those encountered in daily living. Even in the absence of any permanent impairment, the symptoms listed can interfere with job performance and safety.

Mucous membrane irritation can result in inflammation, which may lead to increased susceptibility to nonspecific irritants and infectious agents. For example, experimental ozone exposure in humans results in increased airway reactivity. Also, studies of exposure to environmental tobacco smoke have shown irritative symptoms and evidence of increased frequency of respiratory tract illnesses in young children and decreased pulmonary function in adults.

The American Thoracic Society has identified several points relevant to the issue of respiratory tract irritation.

1. Does the effect interfere with normal activity of the individual?

2. Are there episodes of identifiable respiratory illness?

3. Does the effect result in an incapacitating illness?

4. Is there permanent respiratory injury?

5. Is there progressive respiratory dysfunction?

Particularly on the job, sensory irritation is clearly relevant to point 1. Mucous membrane irritation is associated with respiratory illnesses, depending on the composition of specific exposure and on the dose, duration, and frequency of exposure. No universally applicable conclusion can be drawn at this time regarding the association between irritative symptoms and permanent injury of dysfunction. Where certain individuals show no measurable impairment after an exposure, even when experiencing irritative symptoms, others may develop identifiable dysfunction.

Aside from the effects of irritation, mucous membrane exposure may result in absorption of a substance, with resultant systemic toxicity. An inflamed mucous membrane may be an even more effective route of absorption, either for the irritant or for other substances. Furthermore, injury to bronchopulmonary membranes can impair removal of particulates from the respiratory system.

22. **The question also arises of whether odorants present material impairment of health. That issue also might arise in the context of other substances. Based on the evidence in the final record concerning this issue, OSHA will determine if the criteria detailed in section IV-C-16 have been met, and take appropriate action. OSHA requests comment on this issue.**

Odors emitted by industrial chemicals often play an important role in occupational safety and health. When odors can be detected before health effects occur, they may provide early warning of exposure. A number of chemicals have strong odors at concentrations which are otherwise minimally toxic. These odors may cause undue health concerns among exposed workers or may create safety hazards by distracting workers from their tasks. Strong odors in the workplace may also mask the presence of other, more toxic substances. Strong odors can produce irritation and/or nausea at high concentrations, although these effects may be reversible following cessation of exposure. Olfactory fatigue often occurs and should be considered a functional impairment that can result in increased worker exposure. Olfactory fatigue can reduce the wearer's ability to sense inadequate respirator performance of air-purifying respirators.

23. **Is there exposure information available which can be supplied which will refine OSHA's estimates of employee exposures and over exposures to the substances being regulated?**

NIOSH is submitting for the current rulemaking all relevant Health Hazard Evaluation Reports (HHEs) to the docket. Appendix C is a comprehensive listing of HHEs being submitted. We also have previously submitted to OSHA a copy of data tapes from the National Occupational Health Survey (NOHS). NIOSH anticipates submitting to OSHA a comprehensive listing of pertinent NIOSH exposure information in our post-hearing comments.

24. **Is there information available which can be supplied to improve or supplement the engineering controls identified as necessary in order to reduce exposure levels? Is there additional cost data which can be supplied to refine the annual costs associated with these controls?**

In addition to the material on engineering feasibility provided to OSHA relating to question 15, NIOSH is continuing to evaluate general engineering feasibility data for these substances in this rulemaking that meet OSHA's definition of a potential occupational carcinogen (29 CFR 1990).

25. **Under what conditions, involving which industrial processes, will respirators be needed during the start up period, for maintenance operations, or where other controls are infeasible in order to protect employees at the proposed exposure levels? Are respirators currently being used under the conditions identified, or would they need to be purchased? Please describe the type of respirator currently in use or needed.**

NIOSH concurs with OSHA's assessment in the Non-Regulatory Alternative Section that personal protective equipment should only be used "where it is impractical to apply engineering or work practice controls, or where these applications will not consistently reduce employee exposures below the proposed PEL's." In these instances, NIOSH recommends that the NIOSH Respirator Decision Logic (Appendix D) be used to select the appropriate respirator.

NIOSH has little quantitative information on which respirators are currently being used under the conditions specified by OSHA. A NIOSH contractor's report ("Preliminary Survey of Existing Data and Economic Overview of Respirator Industry," Granville Corporation, March 10, 1982) is submitted to the docket as Appendix E and provides limited data on the numbers and types of respirators sold in the United States. This report used respirator manufacturers' data on respirator sales in 1980 and published data on workers [i.e., Economic Report of the

President, (U.S.G.P.O., Washington, 1981)] to make some estimates on the number of certified respirators being worn by workers in the U.S. The Granville report estimates that 19.1% of mining, manufacturing, and construction workers wore or had access to certified respirators in 1980. In addition, it was estimated that over 20 million manufacturing workers and almost 4.5 million construction workers, and more than 1 million miners used certified respirators. The Granville report also indicated that SCBAs, "disposables," and particulate and chemical cartridge respirators have "large and roughly equal market shares (ranging from 25 to 30%) in terms of total dollar sales" (Granville Report, p. 40).

26. **As a result of simultaneously regulating many substances, what cost savings will be realized in purchasing new engineering controls? Are alternate engineering controls available to achieve the lower permissible exposure limits being proposed?**

NIOSH has no comment with regard to the costs of purchasing new engineering controls. Alternate engineering control methods are discussed in our responses to questions 15 and 19.

27. **What is the current state of technology control and financing in firms which would need to comply with reduced exposure limits to wood dust?**

In addition to the information provided on the individual chemical comments for Wood Dust (H.S. 1430A and 1430B), several innovative designs and devices have been developed to control wood dust in sawing, cutting, sanding and shaping. These published NIOSH references (Huebener DJ [1987]. Dust controls for a wood shaper. Appl Ind Hyg 2(4):164-169; and Hampl V and Johnston DE [1985]. Control of wood dust from horizontal belt sanding. Am Ind Hyg Assoc J 46(10):567-577) have been submitted to the docket as Appendix F.