VIII. REFERENCES

1. API Toxicological Review--Petroleum Naphthas. New York, American Petroleum Institute, 1969, 6 pp

2. Gibbs GB, Hoffman HL: Petroleum products, in Kirk-Othmer Encyclopedia of Chemical Technology, ed 2 rev. New York, Interscience Publishers, 1968, vol 15, pp 77-92

3. Gleason MN, Gosselin RE, Hodge HC, Smith RP: Section II. Ingredients index, in Clinical Toxicology of Commercial Products, ed 3. Baltimore, The Williams and Wilkins Co, 1969, pp 85,97,111,152

4. Stecher PG (ed): The Merck Index--An Encyclopedia of Chemicals and Drugs, ed 8. Rahway, NJ, Merck and Co Inc, 1968, pp 599,619, 697,800,983

5. Scheflan L, Jacobs MB: The Handbook of Solvents. Huntington, NY, Robert E Krieger Publishing Co, 1953, pp 482-83,553,587-88,626

6. Material Safety Data Sheet--USP Petroleum Ether. Bartlesville, Okla, Phillips Petroleum Co, Special Products Division, 1976, 3 pp

7. Material Safety Data Sheet--AOCS Petroleum Ether. Bartlesville, Okla, Phillips Petroleum Co, Special Products Division, 1976, 2 pp

8. Material Safety Data Sheet--Petroleum Ether, No. NPVLA 6-70. Kansas City, Mo, Skelly Oil Co, 1970, 3 pp

9. Carpenter CP, Kinkead ER, Geary DL Jr, Sullivan LJ, King JM: Petroleum hydrocarbon toxicity studies--IV. Animal and human response to vapors of rubber solvent. Toxicol Appl Pharmacol 33:526-42, 1975

10. Elkins HB: Organic compounds--Part I. Hydrocarbons, in Chemistry of Industrial Toxicology. New York, John Wiley and Sons Inc, 1959, pp 98-111

11. Mellan I: Handbook of Solvents--Pure Hydrocarbons. New York, Reinhold Publishing Corp, 1957, vol 1, 249 pp

12. Shell Chemical Hydrocarbon Solvents--East of Rockies, No. SC:99-75. Stamford, Conn, Shell Chemical Co, 1975, 1 p

13. Shell Chemical Hydrocarbon Solvents--West of Rockies, No. SC:101-75. Stamford, Conn, Shell Chemical Co, 1975, 1 p

14. Exxon Petroleum Solvents, No. Lubetext DG-1P. Houston, Exxon Co USA, 1974, 9 pp

15. Crude petroleum, petroleum products, and natural gas liquids--1974--Final summary, in Mineral Industry Surveys--Petroleum Statement, Annual. US Dept of the Interior, Bureau of Mines, Division of Fuels Data, 1976, 41 pp

16. Crude petroleum, petroleum products, and natural gas liquids--December 1975, in Mineral Industry Surveys--Petroleum Statement, Monthly. US Dept of the Interior, Bureau of Mines, Division of Fuels Data, 1976, 31 pp

17. Carpenter CP, Kinkead ER, Geary DL Jr, Sullivan LJ, King JM: Petroleum hydrocarbon toxicity studies--II. Animal and human response to vapors of varnish makers' and painters' naphtha. Toxicol Appl Pharmacol 32:263-81, 1975

18. Organic solvents, in NPIRI Raw Materials Data Handbook--Physical and Chemical Properties, Fire Hazard and Health Hazard Data, vol 1. Bethlehem, Pa, National Printing Ink Research Institute, Francis MacDonald Sinclair Memorial Laboratory, 1974, 14 pp

19. Hygienic guide series--Stoddard solvent (mineral spirits, white spirits). Am Ind Hyg Assoc J 36:553-58, 1975

20. Browning E: Petroleum solvents, in Toxicity and Metabolism of Industrial Solvents. London, Elsevier Publishing Co, 1965, pp 145-58

21. Carpenter CP, Kinkead ER, Geary DL Jr, Sullivan LJ, King JM: Petroleum hydrocarbon toxicity studies--III. Animal and human response to vapors of Stoddard solvent. Toxicol Appl Pharmacol 32:282-97, 1975

22. American Society for Testing and Materials: Standard Specification for Petroleum Spirits (Mineral Spirits), ASTM D235-1961. New York, ASTM, 1973, 1 p

23. ACGIH Committee on Threshold Limit Values: Stoddard Solvent. To be published in Documentation of Threshold Limit Values by American Conference of Governmental Industrial Hygienists

24. The Four Classes of Stoddard Solvent, No. T-448. Silver Spring, Md, National Institute of Drycleaning, 1969, 4 pp

25. Martin AR, Loibl F, Leonhardt GE, Reeves HE: Drycleaning, in Kirk-Othmer Encyclopedia of Chemical Technology, ed 2 rev. New York, Interscience Publishers, 1964, vol 7, pp 307-26

26. National Fire Protection Association: National Fire Codes--A Compilation of NFPA Codes, Standards, Recommended Practices, and Manuals; Flammable Liquids, Boiler-Furnaces, Ovens, NFPA No. 32-1972. Boston, NFPA, vol 1, 1974, pp 32-2 to 32-23

27. API Toxicological Review--Kerosine, ed 2. New York, American Petroleum Institute, 1967, 4 pp

28. Rossini FD, Mair BJ, Streiff AJ: Hydrocarbons from Petroleum--The Fractionation, Analysis, Isolation, Purification, and Properties of Petroleum Hydrocarbons. American Chemical Society monograph series, New York, Reinhold Publishing Corp, 1953, pp 354-55,365,402-05,411,421,434-35

29. API Toxicological Review--Aromatic Petroleum Naphtha, ed 2. New York, American Petroleum Institute, 1965, 5 pp

30. Gafafer WM (ed): Occupational Diseases--A Guide to Their Recognition, PHS publication 1097. US Dept of Health, Education, and Welfare, Public Health Service, 1964, pp 182-83

31. Reed RM: Hydrogen, in Kirk-Othmer Encyclopedia of Chemical Technology, ed 2 rev. New York, Interscience Publishers, 1966, vol 11, pp 347-50,363-65

32. Floret: [Industrial poisoning by hydrocarbons of the aromatic and aliphatic series (chlorinated hydrocarbons) and its prevention.] Zentralbl Gewerbehyg Unfallverhuet 14:257-61, 1927 (Ger)

33. Lawrence JS: Acute poisoning due to petrol vapour. Br Med J 1:871-73, 1945

34. Kulkow AE: [Contribution to the clinic on industrial poisoning.] Z Gesamte Neurol Psychiatr 103:435-54, 1926 (Ger)

35. Hayhurst E: Poisoning by petroleum distillates. Indian Med Rec 5:53-63, 1936

36. Schwartz L: The incidence of occupational dermatoses and their causes in the basic industries. JAMA 111:1523-28, 1938

37. Kjaer K: [Confusion of ether with petroleum ether as an inhalation anesthetic.] Nord Med 50:1666-68, 1953 (Dan)

38. Spruit D, Malten KE, Lipmann EWRM: Horny layer injury by solvents--II: Can the irritancy of petroleum ether be diminished by pretreatment? Berufs-Dermatosen 18:269-80, 1970

39. Oettel H: [Effect of organic liquids on the skin.] Arch Exp Pathol Pharmakol 83:641-44,649-52,693-96, 1936 (Ger)

40. Herskowitz A, Ishii N, Schaumburg H: N-hexane neuropathy--A syndrome occurring as a result of industrial exposure. N Engl J Med 285:82-85, 1971

41. Yamada S: [Polyneuritis in workers exposed to n-hexane, its cause and symptoms.] Jpn J Ind Health 9:651-59, 1972 (Jap)

42. Yamamura Y: N-hexane polyneuropathy. Folia Psychiatr Neurol Jpn 23:45-57, 1969

43. Takeuchi Y, Mabuchi C, Takagi S: Polyneuropathy caused by petroleum benzine. Int Arch Arbeitsmed 34:185-97, 1975

44. Inoue T, Takeuchi Y, Takeuchi S, Yamada S, Suzuki H, Matsushita T, Miyagaki H, Maeda K, Matsumoto T: [Industrial health survey of high incidence of n-hexane intoxication among vinyl sandal manufacturers.] Jpn J Ind Health 12:73-84, 1970 (Jap)

45. Gaultier M, Rancurel G, Piva C, Efthymioc ML: [Polyneuritis and aliphatic hydrocarbons.] J Eur Toxicol 6:294-96, 1973 (Fre)

46. Wilson FW: Toxicology of petroleum naphtha distillate vapors. J Occup Med 18:821, 1976

47. Kegels: [A case of aplastic anemia of a probable occupational origin due to white spirit.] Arch Belg Med Soc Hyg Med Trav Med Leg 16:161-74, 1958

48. Astrand I, Kilbam A, Ovrum P: Exposure to white spirit--I. Concentration in alveolar air and blood during rest and exercise. Scand J Work Environ Health 1:15-30, 1975

49. Astrand P, Rodahl K: Textbook of Work Physiology. New York, McGraw-Hill Book Co, 1970, p 364

50. Gamberale F, Annwall G, Hultengren M: Exposure to white spirit--II. Psychological functions. Scand J Work Environ Health 1:31-39, 1975

51. Braunstein LE: Subacute yellow atrophy of the liver due to solvent. JAMA 114:136-38, 1940

52. Scott JL, Cartwright GE, Wintrobe MM: Acquired aplastic anemia--An analysis of thirty-nine cases and review of the pertinent literature. Medicine 38:119-72, 1959

53. Prager D, Peters C: Development of aplastic anemia and the exposure to Stoddard solvent. Blood 35:286-87, 1970

54. Grant WM: Toxicology of the Eye, ed 2. Springfield, Ill, Charles C Thomas, 1974, pp 801-04

55. Nelson KW, Ege JF Jr, Ross M, Woodman LE, Silverman L: Sensory response to certain industrial solvent vapors. J Ind Hyg Toxicol 25:282-85, 1943

56. Carpenter CP, Kinkead ER, Geary DL Jr, Sullivan LJ, King JM: Petroleum hydrocarbon toxicity studies--VIII. Animal and human response to vapors of 140 flash aliphatic solvent. Toxicol Appl Pharmacol 34:413-29, 1975

57. Cavanagh JR, Wilner PR: Aplastic anemia due to kerosene. Med Ann DC 8:140-44, 1939

58. Johnson DE: Hypoplastic anemia following chronic exposure to kerosene. J Am Med Wom Assoc 10:421-24, 1955

59. Hiebel J, Gant HL, Schwartz SO, Friedman IA: Bone marrow depression following exposure to kerosene--A report of 3 cases. Am J Med Sci 246:91-97, 1963

60. Klauder JV, Brill FA: Correlation of boiling ranges of some petroleum solvents with irritant action on skin. Arch Dermatol Syphilol 56:197-215, 1947

61. Tagami H, Ogino A: Kerosene dermatitis. Dermatologica 146:123-31, 1973

62. Lupulescu AP, Birmingham DJ, Pinkus H: An electron microscopic study of human epidermis after acetone and kerosene administration. J Invest Dermatol 60:33-45, 1973

63. Lupulescu A, Birmingham D, Habowsky J, Pinkus H: Electron microscopic autoradiography of 3H-kerosene in human epidermis. J Cell Biol 59:204A, 1973

64. Lupulescu AP, Birmingham DJ: Effect of lipid solvents on protein, DNA, and collagen synthesis in human skin--An electron microscopic autoradiographic study. J Invest Dermatol 65:419-22, 1975

65. Downing JG: Cancer of skin and occupational trauma. JAMA 148:245-52, 1952

66. Davies NE: Jet fuel intoxication. Aerosp Med 35:481-82, 1964

67. Carpenter CP, Geary DL Jr, Myers RC, Nachreiner DJ, Sullivan LJ, King JM: Petroleum hydrocarbon toxicity studies--XI. Animal and human response to vapors of deoderized kerosene. Toxicol Appl Pharmacol 36:443-56, 1976

68. Nunn JA, Martin FM: Gasoline and kerosene poisoning in children. JAMA 103:472-74, 1934

69. McNally WD: Kerosene poisoning in children--A study of 204 cases. J Pediatr 48:296-99, 1956

70. Truffa O, Montalenti P: [Acute pneumopathy and icterus from accidental ingestion of kerosene.] Minerva Med 60:1403-06, 1969 (Ita)

71. Hamilton-Paterson JL, Browning E: Toxic effects in women exposed to industrial rubber solutions. Br Med J 1:349-52, 1944

72. Kaplan I, Zeligman I: Occupational dermatitis of railroad workers. Arch Dermatol 85:95-102, 1962

73. Ramos H, Shama SK: Health Hazard Evaluation Determination, Report No. 72-107-88 (General Electric Co Inc). Cincinnati, US Dept of Health, Education, and Welfare, National Institute for Occupational Safety and Health, Hazard Evaluation Services Branch, 1973, 8 pp

74. Markel HL, Shmunes E: Health Hazard Evaluation, Report No. 72-33-129 (Barker Greeting Card Co). Cincinnati, US Dept of Health, Education, and Welfare, National Institute for Occupational Safety and Health, Hazard Evaluation Services Branch, 1974, 15 pp

75. Larsen LB, Shmunes E: Occupational health case report, No. 6--Stoddard solvent. J Occup Med 16:276-78, 1974

76. McMichael AJ, Spirtas R, Kupper LL, Gamble JF: Solvent exposure and leukemia among rubber workers--An epidemiologic study. J Occup Med 17:234-39, 1975

77. Knave B, Persson HE, Goldberg JM, Westerholm P: Long-term exposure to jet fuel--An investigation on occupationally exposed workers with special reference to the nervous system. Scand J Work Environ Health 3:152-64, 1976

78. Criteria for a Recommended Standard....Occupational Exposure to Alkanes (C5-C8). To be published by US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health

79. Miyagaki H: [Electrophysiological studies of the peripheral neurotoxicity of n-hexane.] Jpn J Ind Health 9:660-71, 1967 (Jap)

80. Truhaut R, Laget P, Piat G, Nguyen Phu-Lich, Dutertre-Catella H, Vu Ngoc Huyen: [Preliminary electrophysiologic results following experimental poisoning with technical hexane and heptane in white rats.] Arch Mal Prof Med Trav Secur Soc 34:417-26, 1973 (Fre)

81. Swann HE Jr, Kwon BK, Hogan GK, Snellings WM: Acute inhalation toxicology of volatile hydrocarbons. Am Ind Hyg Assoc J 35:511-18, 1974

82. Rector DE, Steadman BL, Jones RA, Siegel J: Effects on experimental animals of long-term inhalation exposure to mineral spirits. Toxicol Appl Pharmacol 9:257-68, 1966

83. Gillespie CA, Rodeheaver GT, Smith S, Edgerton MT, Edlich RF: Airless paint gun injuries--Definition and management. Am J Surg 128:383-91, 1974

84. American Conference of Governmental Industrial Hygienists: TLVs--Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1974. Cincinnati, ACGIH, 1974, 94 pp

85. Deichmann WB, Kitzmiller KV, Witherup S, Johansmann R: Kerosene intoxication. Ann Intern Med 21:803-23, 1944

86. Rebello JA, Suskind RR: The effect of common contactants on cutaneous reactivity to sensitizers. J Invest Dermatol 41:67-80, 1963

87. Carpenter CP, Smyth HF: Chemical burns of the rabbit cornea. Am J Ophthalmol 29:1363-72, 1946

88. Narasimhan MJ Jr, Ganla VG: Experimental studies on kerosene poisoning. Acta Pharmacol Toxicol 25:214-24, 1967

89. Wolfsdorf J, Kundig H: Kerosene poisoning in primates. S Afr Med J 46:619-21, 1972

90. Volkova AP, Tsetlin VM, Zhuk EB, Iizotova EP: [Toxicity of kerosene as a solvent used in aerosol cylinders.] Gig Sanit 34:24-29, 1969 (Rus)

91. Gerarde HW, Eckardt RE: Aspiration hazards of petroleum products, in XIVth International Congress of Occupational Health, Madrid, Spain, Sept 16-21, 1963. International Congress Series No. 62. New York, Excerpta Medica Foundation, 1964, vol II, pp 723-27

92. Gerarde HW: Toxicological studies on hydrocarbons--IX. The aspiration hazard and toxicity of hydrocarbons and hydrocarbon mixtures. Arch Environ Health 6:329-41, 1963

93. Gross P, McNerney JM, Babyak MA: Kerosene pneumonitis--An experimental study with small doses. Am Rev Respir Dis 88:656-63, 1963

94. Schwartz SI, Breslau RC, Kutner F, Smith D: Effects of drugs and hyperbaric oxygen environment on experimental kerosene pneumonitis. Dis Chest 47:353-59, 1965

95. Steele RW, Conklin RH, Mark HM: Corticosteroids and antibiotics for the treatment of fulminant hydrocarbon aspiration. JAMA 219:1434-37, 1972

96. American Conference of Governmental Industrial Hygienists: Air Sampling Instruments for Evaluation of Atmospheric Contaminants, ed 4. Cincinnati, ACGIH, 1972, pp U-6 to U-7

97. McCammon CS Jr: Evaluation of Portable, Direct-Reading Combustible Gas Meters, HEW publication No. (NIOSH) 74-107. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for

Disease Control, National Institute for Occupational Safety and Health, Division of Laboratories and Criteria Development, 1974, 48 pp

98. Willey MA, McCammon CS Jr: Evaluation of Portable, Direct-Reading Hydrocarbon Meters, HEW publication No. (NIOSH) 76-166. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Division of Physical Sciences and Engineering, 1976, 84 pp

99. Cook WA, Coleman AL: Determination of injurious constituents in industrial atmospheres--II. Determination of solvent vapors in air by means of activated charcoal. J Ind Hyg Toxicol 18:194-210, 1936

100. Smith BS, Pierce JO: The use of plastic bags for industrial air sampling. Am Ind Hyg Assoc J 31:343-48, 1970

101. Ray EM: Sampling and determination by ultraviolet absorption of oil mists and solvent vapors. Am Ind Hyg Assoc J 31:472-78, 1970

102. Feldstein M, Balestrieri S, Levaggi DA: The use of silica gel in source testing. Am Ind Hyg Assoc J 28:381-85, 1967

103. Stoddard solvent, in NIOSH Analytical Methods. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Division of Laboratories and Criteria Development, 1975, pp S382-1 to S382-9

104. Petroleum distillate, in NIOSH Analytical Methods. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Division of Laboratories and Criteria Development, 1975, pp S380-1 to S380-9

105. Olkhovskaya ZK: [Colorimetric method for assaying the hydrocarbons, benzene, kerosene, and white spirit in the air of industrial installations.] Gig Tr Prof Zabol 15:57-58, 1971 (Rus)

106. 1976 OSHA Concentration Limits for Gases, No. 20M 2/76. Norwalk, Conn, Wilks Scientific Corp, 1976, 1 p

107. Organic solvents in air, in NIOSH Manual of Analytical Methods. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Physical and Chemical Analysis Branch, 1974, pp 127-1 to 127-11

108. Narayanaswami K, Bami HL: Gas-chromatography in detection of kerosene residues. Int Crim Police Rev 26:216-21, 1971

109. Jansson BO, Larsson BT: Analysis of organic compounds in human breath by gas chromatography-mass spectrometry. J Lab Clin Med 74:961-66, 1969

110. Matsumura Y: The adsorption properties of active carbon--II. Preliminary study on adsorption of various organic vapors on active carbon by gas chromatography. Ind Health 3:121-25, 1965

111. Baker RN, Alenty AL, Zack JF: Simultaneous determination of lower alcohols, acetone and acetaldehyde in blood by gas chromatography. J Chromatogr Sci 7:312-14, 1969

112. Hurst RE: A method of collecting and concentrating headspace volatiles for gas-chromatographic analysis. Analyst 99:302-05, 1974

113. American Conference of Governmental Industrial Hygienists: Air Sampling Instruments--For Evaluation of Atmospheric Contaminants, ed 4. Cincinnati, ACGIH, 1972, p S-36

114. Leichnitz K (ed): Detector Tube Handbook--Air Investigations and Technical Gas Analysis with Drager Tubes, ed 2. Lubeck, Germany, Dragerwerk AG Lubeck, 1973, 164 pp

115. Oberg M: A survey of the petroleum solvent inhalation exposure in Detroit dry cleaning plants. Am Ind Hyg Assoc J 29:547-50, 1968

116. Information Concerning the Development of the Criteria Document and Recommended Health Standard for Refined Petroleum Solvents. Unpublished report submitted to NIOSH by the Institute of Industrial Launderers, Washington, DC, November 24, 1976, 20 pp

117. American Conference of Governmental Industrial Hygienists: TLVs--Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1976. Cincinnati, ACGIH, 1976, pp 1-54

118. NIOSH/OSHA Draft Technical Standards for Set G (Part 2 of 2) as of June 24, 1975. US Dept of Labor, Occupational Safety and Health Administration, Office of Standards, 1975, pp 37-55,74-91

119. American Conference of Governmental Industrial Hygienists, Committee on Industrial Ventilation: Industrial Ventilation--A Manual of Recommended Practice, ed 14. Lansing, Mich, ACGIH, 1976, pp 1-1 to 14-8

120. American National Standard--Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2. New York, American National Standards Institute Inc, 1971, 63 pp

121. Hagopian JH, Bastress EK: Recommended Industrial Ventilation Guidelines, HEW publication No. (NIOSH) 76-162. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for

Disease Control, National Institute for Occupational Safety and Health, Division of Physical Sciences and Engineering, 1976, 330 pp

122. Karches GJ, Ludwig HR, Okawa MT: Health and Safety Guide for Laundries and Dry Cleaners, HEW publication No. (NIOSH) 75-151. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Division of Technical Services, 1975, 63 pp

123. Chass RL, Kanter CV, Elliott JH: Contribution of solvents to air pollution and methods for controlling their emissions. J Air Pollut Control Assoc 13:64-72,96, 1963

124. Hygienic guide series--Petroleum naphtha. Am Ind Hyg Assoc J 24:427-28, 1963

125. Gerarde HW: The aliphatic (open chain, acyclic) hydrocarbons, in Patty FA (ed): Industrial Hygiene and Toxicology, ed 2 rev; Toxicology (Fassett DW, Irish DD, eds). New York, Interscience Publishers, 1963, vol 2, pp 1195-1201

126. Weast RC (ed): Handbook of Chemistry and Physics--A Ready-Reference Book of Chemical and Physical Data, ed 55. Cleveland, CRC Press Inc, 1974, pp C-165,C-166,C-264,C-394

127. Material Safety Data Sheet--Soltrol 50. Bartlesville, Okla, Phillips Petroleum Co, Petrochemical and Supply Division, 1972, 3 pp

128. Fire Hazard Properties of Flammable Liquids, Gases, Volatile Solids 1969, NFPA No. 325M. Boston, National Fire Protection Association, 1969, pp 84-85,116-17

129. Information Concerning the Development of the Criteria Document and Recommended Health Standard for Refined Petroleum Solvents. Unpublished report submitted to NIOSH by the Shell Chemical Co, Houston, March 11, 1977, 1 p

130. National Fire Protection Association: National Fire Codes--A Compilation of NFPA Codes, Standards, Recommended Practices, and Manuals; Flammable Liquids, Boiler-Furnaces, Ovens, NFPA No. 30-1973. Boston, NFPA, 1974, vol 1, pp 30-1 to 30-108

131. National Fire Protection Association: National Fire Codes--A Compilation of NFPA Codes, Standards, Recommended Practices, and Manuals; Electrical, NFPA No. 70. Boston, NFPA, 1974, vol 5, pp 70-77 to 70-78,70-286 to 70-292

132. National Fire Protection Association: National Fire Codes--A Compilation of NFPA Codes, Standards, Recommended Practices, and Manuals; Flammable Liquids, Boiler-Furnaces, Ovens, NFPA No. 36-1973. Boston, NFPA, 1974, vol 1, pp 36-1 to 36-54

133. Vacuum Distillation, No. T-46. Silver Spring, Md, National Association Institute of Dyeing and Cleaning Inc, 1937, 2 pp

134. Howanitz J: Solvents for cleaning electric motors. Water Pollut Control 108:26-27, 1970

135. Recommended Good Practice for Safeguarding the Solvent Extraction of Oils. Hartford, Conn, Factory Insurance Assoc, 1952, 97 pp

136. The use of safety cans and caution in handling and storing flammable liquids. Monitor 46:12, 1973

137. Highly Flammable Liquids and Liquified Petroleum Gases--Guide to the Regulations 1972. London, Her Majesty's Stationery Office, Department of Employment, 1973, 9 pp

138. Bruevich TS, Pugacheva LA: [Hygienic assessment of protective and cleansing preparations in oil refineries.] Gig Sanit 33:21-24, 1968 (Rus)

139. Lupulescu AP, Birmingham DJ: Effect of protective agent against lipid-solvent-induced damages--Ultrastructural and scanning electron microscopical study of human epidermis. Arch Environ Health 31:33-36, 1976

140. American Conference of Governmental Industrial Hygienists: Report of the Sub Committee on Threshold Limits, in Proceedings of the Eighth Annual Meeting, ACGIH, Chicago, April 7-13, 1946, 2 pp

141. Cook WA: Maximum allowable concentrations of industrial atmospheric contaminants. Ind Med 14:936-46, 1945

142. American Conference of Governmental Industrial Hygienists, Committee on Threshold Limit Values: Documentation of Threshold Limit Values. Cincinnati, ACGIH, 1962, pp 53-54,74,95

143. American Conference of Governmental Industrial Hygienists, Committee on Threshold Limit Values: Documentation of Threshold Limit Values, Cincinnati, ACGIH, 1966, pp 96,134,176-77

144. Elkins HB: The Chemistry of Industrial Toxicology. New York, John Wiley and Sons Inc, 1950, pp 101-10

145. Sayers RR, Fieldner AC, Yant WP, Thomas BGH: Experimental studies on the effect of ethyl gasoline. Report of US Bureau of Mines, 1927

146. Drinker P, Yaglou CP, Warren MF: The threshold toxicity of gasoline vapor. J Ind Hyg Toxicol 75:225-32, 1943

147. American Conference of Governmental Industrial Hygienists: Report of the Committee on Threshold Limits, in the Transactions of the 10th Annual Meeting, ACGIH, Boston, April 1948, 3 pp

148. American Conference of Governmental Industrial Hygienists: TLVs--Threshold Limit Values for 1949, in Proceedings of the 11th Annual Meeting, ACGIH, Detroit, April 1949, 3 pp

149. American Conference of Governmental Industrial Hygienists: Threshold Limit Values of Airborne Contaminants and Intended Changes Adopted by ACGIH for 1970. Cincinnati, ACGIH, 1970, pp 1-27

150. American Conference of Governmental Industrial Hygienists, Committee on Threshold Limit Values: Documentation of the Threshold Limit Values for Substances in Workroom Air, ed 3, 1971. Cincinnati, ACGIH, 2nd printing, 1974, pp 233-35

151. Permissible Levels of Toxic Substances in the Working Environment--6th Session of the Joint ILO/WHO Committee on Occupational Health, Geneva, June 4-10, 1968. Geneva, International Labour Office, Occupational Safety and Health Series No. 20. 1970, pp 203,334

152. Winell M: An international comparison of hygienic standards for chemicals in the work environment. Ambio 4:34-36, 1975

153. Albert WC, Inkley SR: The efficacy of steroid therapy in the treatment of experimental kerosene pneumonitis. Am Rev Respir Dis 98:888-89, 1968

154. Gerarde HW: Kerosine--Experimental and clinical toxicology. Occup Health Rev 16:17-21, 1964

155. Guthrie VB (ed): Petroleum Products Handbook. New York, McGraw-Hill Book Co, 1960, pp 11-1 to 11-29,11-44,16-33 to 16-34

156. Elkins HB, Comproni EM, Pagnotto LD: Industrial benzene exposure from petroleum naphtha--II. Pertinent physical properties of hydrocarbon mixtures. Am Ind Hyg Assoc J 24:99-102, 1963

157. Elkins HB, Pagnotto LD: Benzene content of petroleum solvents. AMA Arch Ind Health 13:51-54, 1956

158. Criteria for a Recommended Standard....Occupational Exposure to Benzene, HEW publication No. (NIOSH) 74-137. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, 1974, 137 pp

159. Update Criteria and Recommendations for a Revised Benzene Standard. Cincinnati, US Dept of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, August 1976, 10 pp

160. White LD, Taylor DG, Mauer PA, Kupel RE: A convenient optimized method for the analysis of selected solvent vapors in the industrial atmosphere. Am Ind Hyg Assoc J 31:225-32, 1970

IX. APPENDIX I

BENZENE HAZARD

Benzene, an aromatic hydrocarbon derived primarily through the refinement and fractionation of crude petroleum, has a boiling point of 80.1 C (176 F) at 760 mmHg, and it may be a contaminant of some samples of refined petroleum solvents, especially if the solvent has a boiling range near or encompassing the boiling point of benzene. The extent of this contamination will also vary depending on the inherent chemical composition of the crude oil and the method of distillation in the refinery [155].

It has been shown by Elkins et al [156] that the vapor pressure of benzene in mixtures deviates from Raoult's Law and, therefore, the benzene vapor concentration resulting from handling such mixtures will frequently be higher than would be expected from the composition of the solvent.

Elkins and Pagnotto [157] felt that, if the benzene content of a solvent ranged from 1-4% in volume, ordinary use of the solvent would not produce benzene vapor hazards, but, if the concentration of benzene was greater than 5%, the possibility of "substantial" exposure to benzene vapors resulting from the "free" use of the solvent must be considered.

Benzene has been recognized as causing serious deleterious effects such a blood dyscrasias in humans and experimental animals, and, in 1974, NIOSH issued criteria and recommendations for occupational exposure to this compound [158]. Acute poisoning by benzene results primarily from its narcotic action. The inhalation of a high concentration of benzene (ie, 3,000 ppm for 0.1-1 hour) may cause a state of excitation and euphoria

(benzol jag) followed by drowsiness, fatigue, vertigo, nausea, and vomiting. With higher concentrations (ie, 7,500 ppm for 0.5-1 hour) or longer exposure times, convulsions followed by paralysis, loss of consciousness, and death from respiratory failure may result. The inhalation of small amounts of benzene over long periods have caused blood dyscrasias including aplastic anemia, leukopenia, and thrombocytopenia. Additional signs and symptoms of chronic toxicity may include headache, dizziness, fatigue, loss of appetite, irritability, nervousness, and nosebleed and other hemorrhagic manifestations. When Criteria for a Recommended Standard....Occupational Exposure to Benzene [158] was published, NIOSH recognized that there were data which suggested a relationship between the exposure to benzene and the occurrence of leukemia. However, at that time, there were insufficient epidemiologic investigations of the long-term relations of mortality and morbidity due to leukemia in the population at large and in those who work with benzene to classify it as a carcinogen.

In 1976, NIOSH issued an Update Criteria and Recommendations for a Revised Benzene Standard [159] and recognized that there was now sufficient evidence to conclude that benzene is leukemogenic. Since benzene causes progressive, malignant diseases of the hematopoietic system, NIOSH recommended that, for regulatory purposes, benzene should be considered carcinogenic in man. It was also recommended that the use of benzene as a solvent or diluent in open operations should be prohibited. NIOSH recommended that occupational exposure be controlled so that no worker will be exposed to benzene in excess of 3.2 mg/cu m (1 ppm) in air as determined by an air sample collected at 1 liter/minute for 2 hours.

As a consequence of the toxicity and carcinogenic potential of benzene, the benzene content of a solvent should be determined, and, if it is found to be present, air monitoring should be instituted to ensure compliance to the federal standard. When occupational exposure to benzene occurs, work practices like those described in Criteria for a Recommended Standard....Occupational Exposure to Benzene [158] should be instituted.

X. APPENDIX II

METHOD FOR THE SAMPLING AND ANALYSIS OF PETROLEUM ETHER

Atmospheric Sampling

A combustible gas meter should be used to determine petroleum ether concentrations in areas where exposure is suspected. Instruments used for this purpose must be approved as intrinsically safe by the Mining Enforcement and Safety Administration. When a combustible gas meter is used to evaluate conformance with the recommended environmental limits, a sufficient number of samples must be taken so that representative TWA and ceiling concentrations may be determined.

Sampling Procedure

Follow the instructions which are given in the manual for each combustible gas meter type. Typically, the sampling procedure will require the following steps:

(a) Sweep the combustion chamber free of combustible gases and fill it with fresh air.

(b) Turn on the batteries and apply the proper voltage to the bridge.

(c) Balance the bridge to zero deflection on the meter while the fresh air is in the open chamber.

(d) Draw the air sample into the meter and record the meter reading. Repeat this at least three times; calculate and record the average of the readings.

(e) Determine the concentration of petroleum ether samples from a calibration curve.

(f) Record a description of sampling location and conditions such as temperature, pressure, equipment used, time, rate of sampling, and any other pertinent information.

XI. APPENDIX III

METHOD FOR SAMPLING REFINED PETROLEUM SOLVENTS IN AIR

In order to evaluate conformance with the recommended environmental limits, air concentrations of rubber solvent, varnish makers' and painters' naphtha, mineral spirits, Stoddard solvents, and kerosene must be measured within the individual worker's breathing zone. Sampling procedures must conform with the following criteria.

Atmospheric Sampling

Collect breathing zone or personal samples representative of the individual employee's exposure. At the time of sample collection, record a description of sampling location and conditions, equipment used, time and rate of sampling, and any other pertinent information. Collect enough samples to permit calculation of a TWA exposure for every operation or location in which there is exposure to any refined petroleum solvents.

(a) Equipment

The sampling train consists of a charcoal tube and a vacuum pump.

(1) Charcoal tubes: Glass tubes, with both ends flame-sealed, 7-cm long with a 6-mm OD and a 4-mm ID, containing two sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The primary section contains 100 mg of charcoal, the backup section, 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of glass wool is placed in front of the primary section. Tubes with the above specifications are commercially

available. It should be noted that when conditions of very high humidity exist, evident by the visible condensation within the tube, the collection efficiency of the sampling tube will be seriously reduced.

(2) Pump: A battery-operated pump, complete with clip for attachment to the employee's belt, capable of operating at 200 ml/minute or less.

(b) Calibration

The accurate calibration of a sampling pump is essential for the correct interpretation of the volume sampled. The frequency of calibration is dependent on the use, care, and handling to which the pump is subjected. Pumps should also be recalibrated if they have been misused or if they have just been repaired or received from a manufacturer. If the pump receives hard usage, more frequent calibration may be necessary. Maintenance and calibration should be performed on a regular schedule and records of these should be kept.

Ordinarily, pumps should be calibrated in the laboratory both before they are used in the field and after they have been used to collect a large number of field samples. The accuracy of calibration is dependent on the type of instrument used as a reference. The choice of calibration instrument will depend largely on where the calibration is to be performed. For laboratory testing, a soapbubble meter is recommended, although other standard calibrating instruments can be used. The actual setups will be similar for all instruments.

Instructions for calibration with the soapbubble meter follow. If another calibration device is selected, equivalent procedures should be used. The calibration setup for personal sampling pumps with a charcoal

tube is shown in Figure XIV-1. Since the flowrate given by a pump is dependent on the pressure drop across the sampling device, in this case a charcoal tube, the pump must be calibrated while operating with a representative charcoal tube in line.

(1) Check the voltage of the pump battery with a voltmeter to ensure adequate voltage for calibration. Charge the battery if necessary.

(2) Break the tips of a charcoal tube to produce openings of at least 2 mm in diameter.

(3) Assemble the sampling train as shown in Figure XIV-1.

(4) Turn on the pump and moisten the inside of the soapbubble meter by immersing the buret in the soap solution. Draw bubbles up the inside until they are able to travel the entire buret length without bursting.

(5) Adjust the pump flowmeter to provide the desired flowrate.

(6) Check the mercury manometer to ensure that the pressure drop across the sampling train does not exceed 1 inch of mercury at 1 liter/minute or less.

(7) Start a soapbubble up the buret and measure with a stopwatch the time it takes the bubble to move from one calibration mark to another.

(8) Repeat the procedure in (7) above at least three times, average the results, and calculate the flowrate by dividing the volume between the preselected marks by the time required for the soapbubble to traverse the distance. If, for the pump being calibrated, the volume of

air sampled is calculated as the product of the number of strokes times a stroke factor (given in units of volume/stroke), the stroke factor is the quotient of the volume between the two preselected marks divided by the number of strokes.

(9) Data for the calibration include the volume measured, elapsed time or number of strokes of the pump, pressure drop, air temperature, atmospheric pressure, serial number of the pump, date, and name of the person performing the calibration.

(c) Sampling Procedure

(1) Break both ends of the charcoal tube to provide openings of at least 2 mm, which is half the ID of the tube. A smaller opening causes a limiting orifice effect which reduces the flow through the tube. The smaller section of charcoal in the tube is used as a backup section and therefore is placed nearest the sampling pump. Use tubing to connect the back of the tube to the pump, but tubing must never be put in front of the charcoal tube. The tube is supported in a vertical position within the employee's breathing zone.

(2) Sample a maximum of 10 liters of air at a flowrate not in excess of 200 ml/minute. A sampling rate of 20 ml/minute would collect a volume of 9.6 liters in an 8-hour period. For the determination of ceiling concentrations the sampling time is 15 minutes at a sampling rate of 200 ml/minute. In addition to the personal and ceiling samples, a bulk air sample may also be collected. This air sample should be taken by drawing air through a charcoal tube at 200 ml/minute for 4-6 hours.

(3) Measure and record the temperature and pressure of the atmosphere being sampled.

(4) Treat at least one charcoal tube in the same manner as the sample tubes (break, seal, and ship), except do not draw air through it. This tube serves as a blank.

(5) Immediately after samples are collected, cap the charcoal tubes with plastic caps. Do not use rubber caps. To minimize breakage during transport, pack capped tubes tightly in a shipping container.

Shipping Samples

Prior to shipping, the charcoal tubes should be packed tightly and padded to minimize breakage during shipping. A sample of the bulk material (approximately 20 ml), of the same batch of material which was being used in the plant at the time of the sampling, should be submitted to the laboratory in a glass container with a polymer-lined cap. This sample should not be transported in the same container as the charcoal tubes.