



ASBESTOS CONTAINING MATERIALS (ACM) REVIEW 20170322

1. **ASBESTOS - INTRODUCTION**
2. Ancient Greece "Greek inextinguishable"
3. Roman "Miracle Mineral"
4. **NATURALLY OCCURRING MATERIAL**
5. Commercially Mined:
 6. Chrysotile – white (95% of ACBM)
 7. Amosite – brown
 8. Crocidolite – blue
9. Non-Commercial - Impurities
10. Tremolite (Vermiculite)
11. Anthophyllite - gray
12. Actinolite (Finland)
13. **Aerodynamics:**
14. Fiber: A particle $\geq 5\mu\text{m}$ - Ratio $\geq 3:1$
15. **PHYSICAL ATTRIBUTES:**
16. Good thermal & electrical insulator
17. High Tensile Strength
18. Resistant to Chemicals
19. Plentiful and Inexpensive
20. **CATEGORIES OF ACM:**
21. Surfacing – Sprayed on or trowel applied
22. Thermal System Insulation – Inhibit heat transfer or prevent condensation
23. Miscellaneous (EPA) – Other (OSHA)
24. **DEFINITIONS:**
25. Asbestos-Containing Material (ACM) – a material or product which contains $> 1\%$ asbestos – NIST Lab
26. Friable – when dry, can be crumbled, pulverized, or reduced to powder with hand pressure (EPA)
27. Intact – has not been crumbled, pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound within its matrix (OSHA)
28. **IDENTIFICATION OF ACM – Microscopy**
29. Polarized Light Microscopy (PLM) – Lump
30. Transmission Electron Microscopy (TEM)-Expensive
31. Phase Contrast Microscopy (PCM) – Cheap
32. Bulk Samples - PLM or TEM
33. Air Samples – PCM or TEM
34. **HEALTH EFFECTS**
35. Primary Entry: Inhalation
36. Secondary Entry: Ingestion
37. Natural Defense Mechanisms Of The Human Body:
 38. Nose Hairs – a crude air filter
 39. Cilia - "Mucociliary Escalator"
 40. Macrophage – giant white blood cells
41. Risk Factors
 42. Duration & Intensity Of Exposure – Cumulative
 43. Age at First Exposure
 44. Type Of Asbestos Inhaled
 45. Synergistic - Cigarette Smoking + work with asbestos unprotected – 80X RISK
46. **ASBESTOS RELATED DISEASES**
47. ASBESTOSIS – (Not a Cancer)
48. Cumulative Fibrotic Scarring, dose response
49. Diffuse Interstitial Fibrosis
50. Pneumoconiosis
51. Caused By Accumulation Of Fibers In Lung
52. White Blood Cell Defense Ineffective
53. LUNG CANCER – Most Common, Dose Response
54. Greatest Risk Asbestos Workers $> \frac{1}{2}$ Of Deaths
55. Mucociliary Escalator - Nicotine Paralyzes
56. Latency Period > 20 Yrs & Peaks 30-35 Yrs
57. Strong Cumulative Dose-Response Relationship
58. MESOTHELIOMA – Not Dose Related
Cancer of the Lung Lining Or Abdominal Lining,
59. Both Pleural And Peritoneal Mesothelium
60. Accounts For 10-18% Of Deaths
61. Extremely Rare In Unexposed Population
62. Latency Period Of 25 - > 40 Years
63. Rarely Curable & Usually Fatal < 1 Year
64. **MEDICAL SURVEILLANCE - Triggers**
65. 1)Exposure \geq PEL > 30 days/year or
66. 2)Perform Class I, II, or III work > 30 days/year or
67. A combination of 1) & 2) above or
68. Wearing a Negative Pressure Respirator
69. **MEDICAL SURVEILLANCE – Annual Requirements**
70. Medical questionnaire (work and medical history)
71. Pulmonary Function Test (PFT)
72. Chest X-Ray (if required by Physician)
73. Examination by licensed health care professional
74. Information To Physician
75. Copy Of Standard And Appendices
76. Description Of Duties
77. Representative Exposure Levels
78. Description Of PPE Used
79. Information from Physician
80. Written Opinion - Results Of Medical Exam
81. Medical Conditions Which Place Employee At Increased Risk From Exposure
82. Employee Limitations/Restrictions On PPE
83. Examination Results & Medical Conditions Which May Result From Asbestos Exposure
84. **PERSONAL PROTECTIVE EQUIPMENT (PPE)**
85. Respirators
86. HEPA (99.97% $< 0.3\mu\text{m}$) N, R, P-100
87. Written Respirator Protection Plan
88. Written Medical Surveillance Plan
89. Fit Test - Annual
90. Qualitative - Chemicals
 91. Saccharin, Banana Oil (isoamyl nitrate), Bitrex, Irritant Smoke (Stannic Chloride)
92. Quantitative - Instrument
93. Portacount, Quantifit
94. User Seal Check – Each Use
95. Coveralls, Gloves, Shoes, Hard-hats, etc.
96. **RECORDKEEPING**
97. Medical Records – Length of Employment + 30 Years
98. Exposure Monitoring – 30 Years
99. Training – Length of Employment + 1 Year

100. REGULATIONS – CONFINE & MINIMIZE

101. Worker Protection – Confine & Minimize

- 102. Construction - OSHA 29CFR1926.1101
- 103. Four Classes of Asbestos Work
- 104. Exposure Assessment and Monitoring
- 105. Methods of Compliance
- 106. Regulated Area – Behind Barriers & Signs
- 107. Personal Protective Equipment
- 108. Communication of Hazards
- 109. Medical Surveillance
- 110. Recordkeeping
- 111. **ASBESTOS RESPONSE ACTIONS**
 - 112. O&M Programs, Repair, Encapsulation, Enclosure & Removal
 - 113. OSHA Two Day O&M Worker Training
 - 114. <3 sq. or lin. feet friable ACM
- 115. Shipyards – OSHA 29CFR1915.1001
- 116. General Industry – OSHA 29CFR1910.1001
- 117. PEL History – 12 f/cc ('70), 10 ('71), 5 ('72), 2 ('76), 0.2 ('86), & 0.1 f/cc ('94)

118. OSHA Asbestos Classes of Work

- 119. **Class I (32 hr.) – TSI & Surfacing**
 - 120. > 25 ln.' or 10 sq.' - Decon required
 - 121. < 25 ln.' or 10 sq.' - Change area if no NEA
 - 122. Competent Person required (40 hr.)
- 123. **Class II (8 hr.) (Job Specific – NOT in SC)**
 - 124. Unlimited, no quantity designated
 - 125. ACM - NOT TSI & Surfacing e.g. Flooring, Roof
 - 126. Competent Person required (40 hr.)
- 127. **Class III (16 hr.) Operations & Maintenance**
 - 128. ACM - “ACM likely to be disturbed”
 - 129. ≤ 60”x60” waste/glove bag (2 people, <150F)
 - 130. Competent Person required (16 hr.)
- 131. **Class IV (2 hr.) Awareness - Custodial Competent Person required (16 hr)**
 - 132. May contact, but NOT disturb
 - 133. Custodial (2 hr. Training) ≤ 3' ln/sq

134. Negative Pressure Enclosure = NPE <0.02” H₂O

- 135. # NAMS = for 4 air changes per hour =
- 136. $[\text{Vol ft}^3 * 4/\text{hr}] / [60 \text{ min/hr} * \text{NAM} (\text{ft}^3/\text{min})]$
- 137. $[\text{Vol ft}^3] / [15 \text{ min} * \text{NAM} (\text{ft}^3/\text{min})]$

138. Asbestos Hazard Emergency Response Act 1986

- 139. AHERA Applies to all Schools K – 12 Interiors
- 140. Asbestos Inspection and Management Plan
- 141. Requires Re-inspection of ACM Every 3 Years by an Accredited Inspector
- 142. LEA Periodic Surveillance Every 6 Months
- 143. Annual Notification to Parents, Staff & Workers
- 144. Established Model Accreditation Plan (MAP) Worker (4-Day), Supervisor (5-Day), Inspector (3-Day), Management Planner (2-Day), Project Designer (3-Day)
- 145. Abatement Schools = TEM Clearance
- 146. Major Fiber Release >3'ln/sq = PCM Clearance
- 147. Minor Fiber Release ≤3'ln/sq

148. National Emission Standard for Hazardous Air Pollutants (NESHAP) – Revised 1990

- 149. ACM Inspection Prior to Renovation/Demolition of Public/Commercial Facility < 3 yrs old.
- 150. Large ACM Abatement Projects (>260 ln.', 160 sq.', or 35 cu.)
 - 151. Notification 10 Days & Wet Methods
 - 152. No Visible Emissions & Waste Disposal
- 153. Category I - non-friable ACM pliable gasket, resilient floor covering, mastic or asphalt roofing > 1% asbestos. Must be removed before demolition if they have become friable through damage or are likely to during demolition.
- 154. Category II - non-friable ACM any not covered under Category I. Includes rigid exterior siding/boards (transite) & must be removed from a structure before demolition

155. Waste Disposal – Authorized Landfill

- 156. HEPA Vacuum Collapse Waste Bags (6 mil)
- 157. “Gooseneck” Seal Bag & Double Contain
- 158. OSHA, DOT, EPA Generator Labels
- 159. Transport – Single Layer Lined 6mil Poly
- 160. Cover w/ 6” Fill in 24 hours

161. Asbestos School Hazard Abatement Reauthorization Act (ASHARA) - 1992

- 162. Federal Funds for School Abatement Activities
- 163. Placed MAP Requirements ACM Activities in Public/Commercial Facilities
- 164. Excluded Management Planner & O&M Worker

165. S.C. DHEC 61-86.1 (Revised May 22, 2011)

- 166. Training, Licensing, Notifications
- 167. Work Practice Site Audits
- 168. **Projects ≥ 3,000 sq.', 1,500 ln.', or 656 cu.'**
 - 169. Licensed Project Designer & Air Monitor
 - 170. TEM Clearance
- 171. **NESHAP Project (10 Day Notification)**
 - 172. ≥260 ln.', 160 sq.', or 35 cu.'
 - 173. Supervisor in Containment Required
- 174. **Small Project (4 Day Notification)**
 - 175. < 260 ln.', 160 sq.', or 35 cu.'
 - 176. > 25 ln.', 25 sq.' or 10 cu.'
 - 177. Supervisor in Containment Required
- 178. **Minor Project (2 Day Notification)**
 - 179. < 25 ln.', 25 sq.' or 10 cu.'
- 180. **O&M Project (Quarterly) Notification**
 - 181. ≤ 60”x60” waste or single glove bag

182. ASBESTOS LIMITS – “NO SAFE LEVEL”

- 183. EPA PCM Air Clearance - 0.01 fibers/cm³
- 184. EPA TEM Air Clearance - 70 s/mm²
- 185. OSHA PEL 0.1 fibers/cm³ OSHA 8hr TWA
- 186. OSHA Excursion 30 Min. Limit = 1.0 fibers/cm³
- 187. EPA Drinking Water - 7 Million fibers/liter (>10um)
- 188. Surface Samples - >260 s/cm² for wipes, or >1000 s/cm² for a micro-vacuum sample
- 189. ACM or ACBM > 1.0% Asbestos

190. Legal, Insurance & Contracts

- 191. Liable – legally obligated; responsible
- 192. Liability – something for which one is liable; an obligation, a responsibility, or a debt
- 193. Vicarious Liability – Indirect Legal Liability
- 194. Potential Liability
 - 195. Criminal – violation of a statute
 - 196. Regulatory – violation of regulatory agencies
 - 197. Civil – typically controversies - private parties
 - 198. Tort – “Wrong” – Proof of Negligence
- 199. Protection from Liability
 - 200. Do the “Right Thing in the Right Way”
 - 201. Use “State of the Art” & Accepted Methods
 - 202. Purchase Insurance - one party indemnify or guarantee another against loss
 - 203. “Claims-Made” – limits time - claims filed during policy period; problem - latency ACM diseases
 - 204. “Occurrence-Based” – extends filing of claims
 - 205. Errors & Omission E&O – professional mistakes.
- 206. Bonds – Type of Insurance
 - 207. Bid Bonds – pre-qualify bidders & sincerity
 - 208. Payment and Performance Bonds
 - 209. Insure all workers, suppliers, and subcontractors are paid
 - 210. Insure project is completed
 - 211. Protects from contractor default
- 212. Contracts
 - 213. Written or Oral Agreement
 - 214. Contract Documents
 - 215. Specifications
 - 216. Drawings
 - 217. Submittals
 - 218. Addenda
 - 219. Change Orders
 - 220. Means & Methods
 - 221. “Proprietary Methods”
 - 222. Contract Changes
 - 223. Addendum – Before the Bid Is Awarded
 - 224. Change Order – After the Bid is Awarded \$\$

225. FOUR BASIC BUILDING SYSTEMS:

- 226. Structural System – the skeleton of the building (beams, columns, foundation)
- 227. Mechanical System – heat, ventilation & HVAC
- 228. Plumbing System – water, gas, or fluids piping
- 229. Electrical System – power and lighting systems

230. CONSTRUCTION DRAWINGS

- 231. By Discipline
 - 232. Architectural
 - 233. Structural
 - 234. Mechanical
 - 235. Plumbing
 - 236. Electrical
- 237. TYPES OF DRAWINGS:
 - 238. Plans
 - 239. Elevations
 - 240. Sections
 - 241. Details
 - 242. Notes
 - 243. Schedules

244. WORKPLACE SAFETY

- 245. Construction “Fatal Four”
 - 246. Falls - 359 of 899 deaths in 2014 (39.9%)
 - 247. Electrocutions - 74 (8.2%)
 - 248. Struck by Object - 73 (8.1%)
 - 249. Caught-in/between - 39 (4.3%)
- 250. Top 10 OSHA Citations
 - 251. Fall protection ([29 CFR 1926.501](#))
 - 252. Hazard communication ([29 CFR 1910.1200](#))
 - 253. Scaffolding, ([29 CFR 1926.451](#))
 - 254. Respiratory protection ([29 CFR 1910.134](#))
 - 255. Control of hazardous energy (lockout/tagout), general industry ([29 CFR 1910.147](#))
 - 256. Powered industrial trucks ([29 CFR 1910.178](#))
 - 257. Ladders, construction ([29 CFR 1926.1053](#))
 - 258. Electrical ([29 CFR 1910.305](#))
 - 259. Machine Guarding ([29 CFR 1910.212](#))
 - 260. Electrical design, ([29 CFR 1910.303](#))

261. ASBESTOS – ACM/ACBM INSPECTION

- 262. Determine the Location, Estimate Quantity, Assess Present Condition (Friable?) & Potential for Disturbance (Contact, Vibration, Air Erosion)
- 263. Homogeneous areas – Sampling Suspect ACBM
- 264. Functional spaces – Physical Assess Suspect ACBM
- 265. Sampling - TSI
 - 266. AHERA - 3 samples + 1 from Patches <6 ln’
 - 267. DHEC – 3 Samples + 3 from Patches <6 ln’
- 268. Surfacing
 - 269. < 1,000 sq. ft. - 9 recommended, 3 required
 - 270. >1,000 sq. ft. < 5,000 sq. ft. -- 9 reco, 5 required
 - 271. >5,000 sq. ft. -- 9 reco, 7 required
- 272. Miscellaneous
 - 273. AHERA 2 Samples
 - 274. SC DHEC 3 samples
 - 275. (NOBS neg by PLM, then TEM)

276. ASTM E2356 ACM Quantitative Protocol

- 277. Current Condition (CC=1=Poor, CC=10=Good)
- 278. Potential for Disturbance (PFD=1=Low, 10=High)

- 279. AHERA Assessment Categories - blistering, crumbling, deterioration, adhesive failure, water stains, gouges, or mars, powder, dust, debris
- 280. Hazard Rank (7-1 Scale 7=Good, 1=Worst)
- 281. Significantly Damaged > 25% local or >10% even
- 282. Damaged -- < 25% localized or <10% even
- 283. “Least burdensome method which protects human health and the environment”
- 284. Cost Estimation Software
- 285. Xactware.com (Xactimate) or RSMeans.com