

What is Tobacco Smoke?

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Environmental Tobacco Smoke (ETS):

The term ETS is used to describe the material in indoor air, which results from tobacco smoking. Environmental tobacco smoke: A complex mixture of chemical constituents and particulates released into the atmosphere from the burning tip of a cigarette, pipe or cigar or from smoke exhaled by the smoker.

Introduction to tobacco smoke

Tobacco smoke is a complex mixture of several thousand chemical compounds some in tiny quantities that are the product of burning the ingredients of the tobacco product. These include particulates (tar) of sticky solids, gases such as carbon monoxide, and volatiles. Most importantly, the smoke contains nicotine the addictive drug. This mixture is constantly changing as the smoke ages - chemicals in the smoke and background atmosphere react with each other and change under the effect of ultra-violet light. The chemical composition changes over time.

There are two types of smoke:

1. Mainstream smoke: this is the smoke created when the smoker draws on the cigarette and inhales.
 2. Sidestream smoke: this is the smoke created as the cigarette smolders while not being inhaled.
- Both types of smoke end up in the atmosphere around the smoker but they differ in chemical composition primarily because the mainstream smoke is formed at a higher temperature (as air is drawn through it, fanning the flame) and may be filtered as it passes through the cigarette and body.

How many chemicals are in tobacco smoke?

It is often said that "smoke contains over 4,000 chemicals" (see example US-EPA). But what does this number actually mean? It may be that 4,000 have been identified in smoke, but numbers like this are easily misunderstood. How many chemicals are present depends on where one draws a line of relevance how much has to be present before the chemical is counted? Obviously the line could be drawn at the single molecule, in which case many more than 4,000 detected might be present - most undetectable with lab instruments. But the same applies to car exhausts, BBQs, garden bonfires and even to ambient fresh air. The number is not really meaningful in public health terms if it includes chemicals where there is only a single molecule present. The number of chemicals itself is not really important - what matters is the toxicity of the chemicals and how much of the toxic chemicals are present. Smoke would be more harmful with a smaller number of more harmful chemicals in greater concentrations.

ETS contains:

- 5 regulated hazardous air pollutants
- 47 regulated hazardous wastes
- 60 known or suspected carcinogens
- More than 100 chemical poisons.

- ✓ Sales Call
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Yes I would like more information on removing ETS from indoor & outdoor applications!

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Call Time: _____ AM: _____ PM: _____

OSHA Ventilation *ETS Workshop Analysis

N.B.: The following substances are listed as in tobacco smoke. Although few of them have been actually measured in secondhand smoke, all of them have been measured in mainstream and to a lesser extent, sidestream smoke. Secondhand smoke consists of fresh and aged exhaled mainstream and sidestream smoke, and mainstream smoke is formed in the same burning cone as sidestream. Generally, sidestream and secondhand smoke contain greater total quantities of given chemicals (e.g., more NO₂ and more NNK), and are more toxic than mainstream smoke, which is formed at a higher temperature, and is also filtered by the tobacco rod and the cigarette filter.

Compound(s) Listed in Tables 5,6,7,8 or 9 in Ref. 4 or in Ref.5, Chapter 14.
Poison (Y=yes) Superscripts refer to references sources above

Chemicals Found in Tobacco Smoke

- | | | |
|---|--|---|
| 1. 1,1-Dimethylhydrazine Y 4 | 43. DDT Y 5,2 | 74. N ^o -Nitrosornicotine Y 4 |
| 2. 1-Methylindole Y 5 | 44. Dibenz(a,h)acridine Y 4 | 75. N-Nitrosodiethanolamine Y 4 |
| 3. 2-Naphthylamine Y 4 | 45. Dibenz(a,h)anthracene Y 4 | 76. N-Nitrosodiethylamine Y 4 |
| 4. 2-Nitropropane Y 4 | 46. Dibenz(a,j)acridine Y 4 | 77. N-Nitrosodimethylamine Y 4 |
| 5. 2-Toluidine Y 4 | 47. Dibenzo(a,i)pyrene Y 4 | 78. N-Nitrosoethylmethylamine Y 4 |
| 6. 3-Vinylpyridine Y 4 | 48. Dibenzo(a,l)pyrene Y 4 | 79. N-Nitrosomorpholine Y 4 |
| 7. 4,4-dichlorostilbene Y 5 | 49. Dimethylamine Y 2,6 | 80. N-Nitrosopyrrolidine Y 4 |
| 8. 4-(Methylnitrosamino)-1-(3-pyridil)-1-butanone (NNK) Y 4 | 50. Endosulfan Y 5 | 81. Naphthalene Y 1 |
| 9. 4-Aminobiphenyl Y 4 | 51. Endrin Y 5,2 | 82. Nickel Y 4 |
| 10. 5-Methylchrysene Y 4 | 52. Ethylcarbamate Y 4 | 83. Nicotine Y 4 |
| 11. 7H-Dibenzo(c,g)carbazole Y 4 | 53. Fluoranthenes (5) Y 2 | 84. Nitric oxide Y 4 |
| 12. 9-Methylcarbazole Y 5 | 54. Fluorenes (7) Y 2 | 85. Nitrogen dioxide (NO ₂) Y 4 |
| 13. Acetaldehyde Y 4 | 55. Formaldehyde Y 1 | 86. NNN Y 4 |
| 14. Acetone Y 4 | 56. Formic acid Y 1 | 87. Nornicotine Y 3 |
| 15. Acetonitrile Y 1 | 57. Furan Y 2 | 88. o-Toluidine Y 4 |
| 16. Acrolein Y 4 | 58. Hydrazine Y 4 | 89. Palmitic acid Y 2 |
| 17. Acrylonitrile Y 4 | 59. Hydrogen cyanide Y 4 | 90. Parathion Y 5 |
| 18. Alkylcatechols Y 5 | 60. Hydrogen sulfide Y 1 | 91. Phenol Y 2 |
| 19. Ammonia Y 1 | 61. Hydroquinone Y 5,2 | 92. Phenols (volatile) Y 4 |
| 20. Anabasine Y 3 | 62. Indeno(1,2,3-c,d)pyrene Y 4 | 93. Picolines (3) Y 3 |
| 21. Aniline Y 1 | 63. Indole Y 2 | 94. Polonium-210 Y 4 |
| 22. Anthracenes (5) Y 2 | 64. Isoprene Y 2 | 95. Propionic acid Y 1 |
| 23. Antimony Y 2,5 | 65. Lead Y 4 | 96. Pyrenes (6) Y 2 |
| 24. Arsenic Y 4 | 66. Lead 210 Y 5 | 97. Pyridine Y 1 |
| 25. Benz(a)anthracene Y 4 | 67. Limonene Y 2 | 98. Quinolines (7) Y 2 |
| 26. Benzene Y 4 | 68. Manganese Y 5,2 | 99. Styrene Y 1 |
| 27. Benzo(a)pyrene Y 4 | 69. Mercury Y 5,2 | 100. Toluene Y 1 |
| 28. Benzo(b)fluoranthene Y 4 | 70. Methanol Y 1 | 101. Toluidine(s) Y 2 |
| 29. Benzo(j)fluoranthene Y 4 | 71. Methyl formate Y 1 | 102. Urethane Y 5,2 |
| 30. Benzo(k)fluoranthene Y 4 | 72. Methylamine Y 1 | 103. Vinyl chloride Y |
| 31. Benzofurans (4) Y 2 | 73. N ^o -Nitrosoanabasine Y 4 | |
| 32. Butadiene Y 1 | | |
| 33. Butyrolactone Y 6 | | |
| 34. Cadmium Y 4 | | |
| 35. Carbon monoxide Y 4 | | |
| 36. Carbonyl sulfide Y 4 | | |
| 37. Catechol Y 4 | | |
| 38. Chromium Y 4 | | |
| 39. Chrysene Y 4 | | |
| 40. Cresols (all 3 isomers) Y 5 | | |
| 41. Crotonaldehyde Y 4 | | |
| 42. DDD Y 5,2 | | |

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Proper Design and Use of Gas-Phase Air Filtration Systems for the Control of Environmental Tobacco Smoke