The Health Impacts of Uncontrolled Coal Fires

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Jharia Coalfield, India



Witbank Coalfield – South Africa





Anthracite Region, U.S.A.

# **Toxic Gas Components**

Typical Gas analyses reveals the presence of numerous compounds that are potential health hazards; many have no recorded toxicity in air.

Elements	Concentration (ppm)	US EPA Standards (ppm)	
Benzene	6	0.03	
Toluene	1	0.03	
Xylene	1	-	
CO <sub>2</sub>	6500	9	
CO	24 000	35	
CH <sub>4</sub>	50 000	-	

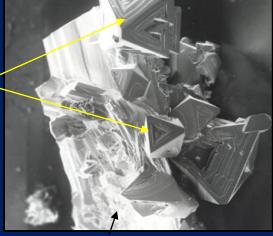
## Orpiment





Arsenolite

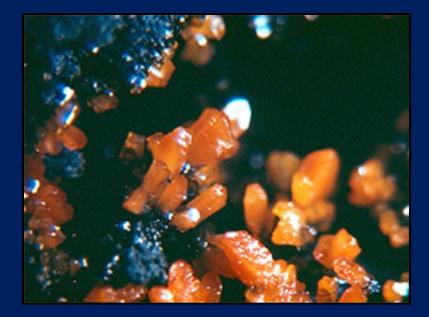
 $(As_2O_3)$ 



Laphamite (As<sub>2</sub>Se<sub>3</sub>)



#### Amorphous arsenic



### Realgar (AsS)

### Laphamite (As<sub>2</sub>Se<sub>3</sub>) Arsenolite (As<sub>2</sub>O<sub>3</sub>)



#### **Downeyite** (SeO<sub>2</sub>)

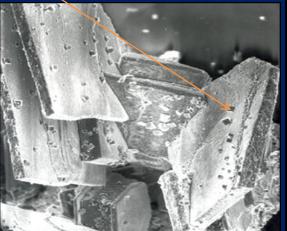


#### Elemental selenium

KAlF4



Galena (PbS) on Berndtite (SnS2)











Dr. SK Bhagania, a physician at a private clinic in Jharia town, a 10-minute walk from the village. He estimates that more than 25% of the ailments he treats may have been triggered by the fumes.

**Control Group** 

**Exposed Group** 

#### Distance vs Problems 0.6 y = -0.0487x + 0.3271 $R^2 = 0.5798$ 0.5 Percentage Problems 0.4 0.3 0.2 0.1 0 3 0 1 2 4 5 Distance

Those people living closer to the fires were 98% more likely to report health problems.

Dhar, U., Balogun, A. H., Finkelman, R. B., Chakraborty, S., Olanipekun, O., Shaikh, W. A., and Stracher, G., 2018, Evidence of human health impacts from uncontrolled fires in Jharia, India. In Coal and Peat Fires: A Global Perspective, Glenn B. Stracher, editor, Elsevier. p.344-358.

### sal ammoniac (NH4C1)

BES 15.0kV WD10mh P.C.50 30Pa x800

20µm 0002 Feb 12, 2020

BES 15.0k

30Pa x750 20µm

Jul 15, 2020

0003

Unknown iodine mineral on cryptohalite/bararite [(SH4)28(F6)

30Pa x370 50µm

BES 15.0kV WD10mm P.C.60 30Pa x600 20un LP2 Condensate



# Fluorine concentration in mg/kg – Max. (average)

	Bastacola	Levripathra	Lodhna
Coal	622 (480)	442	
Condensates	615 (462)	380,000! (65,000)	559 (339)
Plants - Roots	337 (285)	2560 (1111)	182
Plants - Shoots	449 (263)	1940 (1023)	298
Plants - Leaf	481 (345)	7093 (3003)	457
Soil	415 (373)	328	
Water		134	150

Typical concentrations: coal 100 ppm; leaf 5-30 ppm; soil 300-400 ppm; fresh water less than 1 ppm.

### Jharia, India



"The fire like a hungry demon would devour all of us, and pollution would only hasten the diminishing process."

