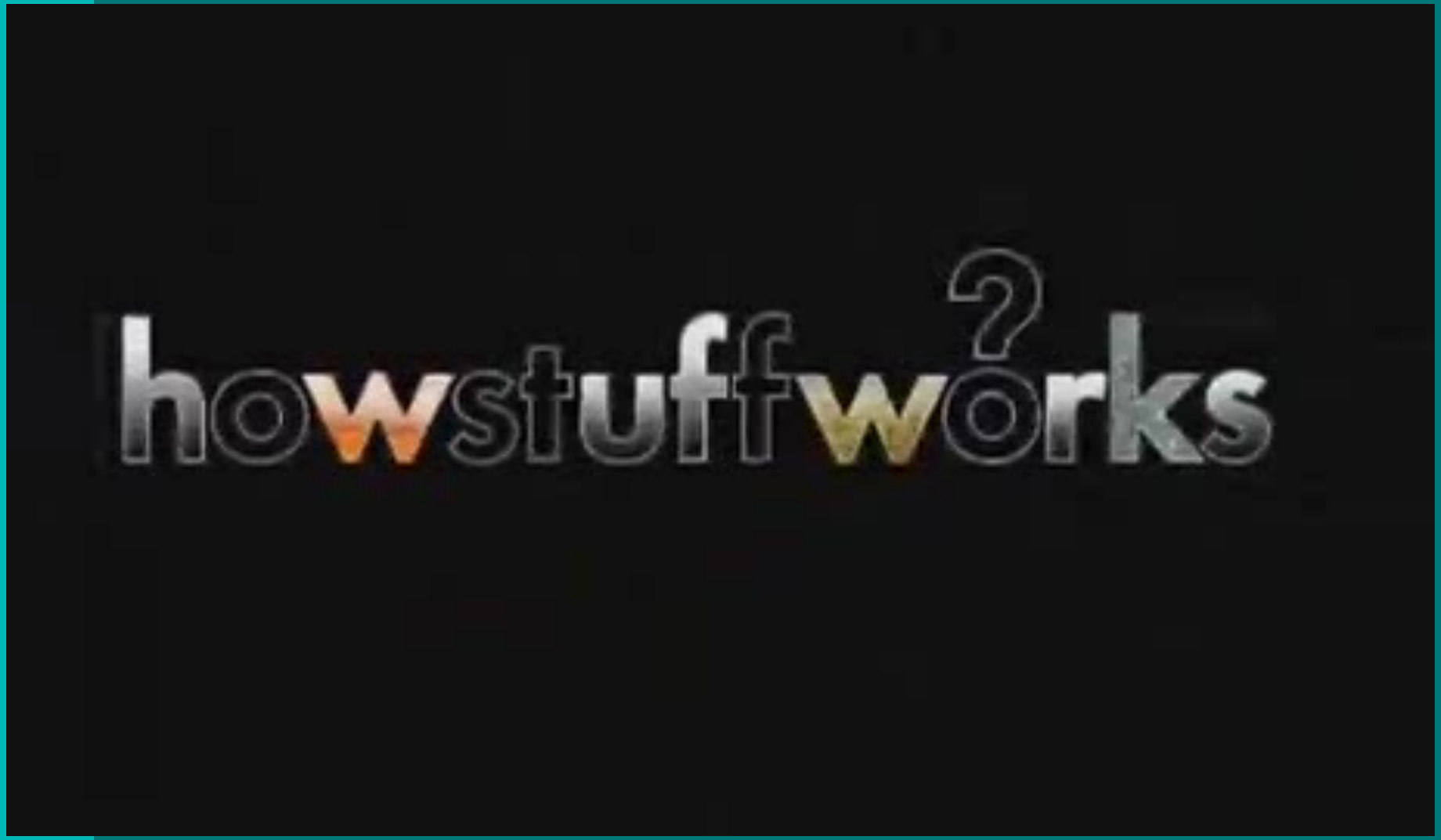
Environmental Impact of Recycling Paper

Environmental Toxins, CU Boulder Jun 2013

A Little Background Information



Most Common Chemicals

Risk of Cancer among paper recycling workers - Danish Cancer Society
The Journal for Occupational and Environmental Medicine. 1997 October; 54(10): 729–733.

Chemicals Used:

fatty acid derivatives, hydrogen peroxide, sodium bisulphite, sodium hydroxide, sodium silicate, sodium dithionite, aluminum sulphate, chlorine, hypochlorite, polyethylenimine, (diethylenetrinitrilo)penta-acetic acid, bentonite, kaolin, resins, acrylamide polymers, thiazole compounds, bromine compounds, and copper compounds.

Effluent Chemicals:

Polychlorinated dibenzofurans (PCDFs)
Polychlorinated dibenzodioxins (PCDDs)
2,3, 7, 8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) & other dioxins

(PCDDs) and PCDFs in paper products have been found in the highest concentrations in the pulp from recycled paper.

Dioxin

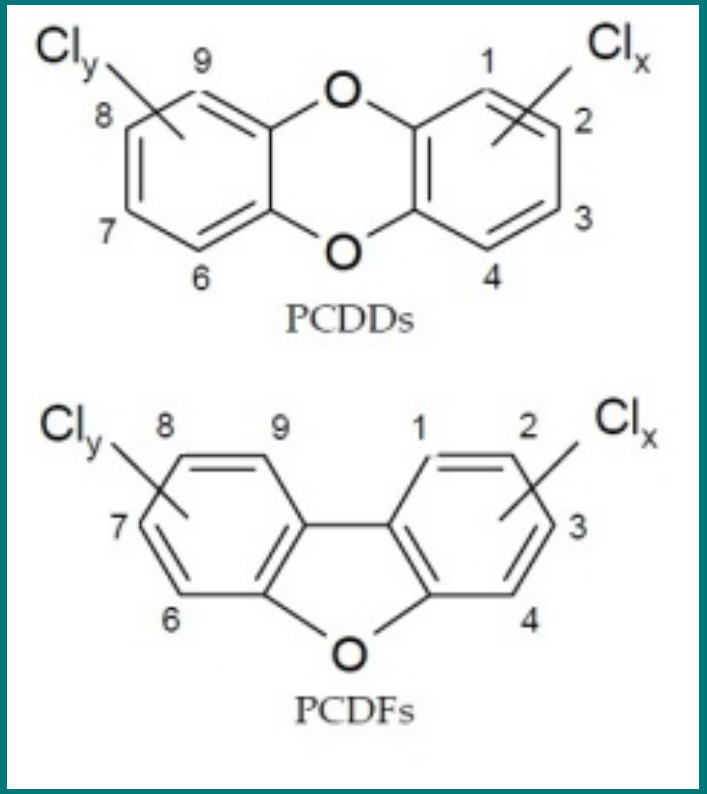
Mutagens in a River Heavily Polluted With Paper Recycling Wastes
E. Klekowski, D. E. Levin. Environmental Mutagenesis. 1979; 1(3): 209-219.

• Toxicity of various tetrachlorodioxins, for example, may vary by a factor of 100,000 or more.

•Dioxins and dibenzofurans chlorinated in the 2, 3, 7, and 8 positions have been demonstrated to be carcinogens.

Chlorinated dioxins and dibenzofurans have been considered toxic air contaniments since 1986.

Chromosomal mutations were found at a very large incidence rate in ferns in a river contaminated by paper recycling effluent.



Chronic Respiratory Symptoms in Paper-Recycling Workers (Skin Test Method)

Respiratory Function and Immunological Status in Paper-Recycling Workers.
Journal of Occupational & Environmental Medicine. 40(11):986-993, November 1998.

- 101 male employees from one paper recycling plant (96% of the plant).

vs

- 87 nonexposed workers employed in food packing plants

- FVC, FEV1, FEF50, and FEF25 were compared as well as
- Chronic cough, phlegm, bronchitis, and dyspnea.

Group	Skin Test†	Mean Age‡ (years)	Mean Exposure‡ (years)	*n*	Chronic Cough	Chronic Phlegm	Chronic Bronchitis	Dyspnea Grades 3 and 4	Occupational Asthma	Sinusitis	Nasal Catarrh
Paper (*n* = 101)	+	39 ± 12	15 ± 11	31	11 (35.5%)	11 (35.5%)	10 (32.3%)	5 (16.1%)	2 (6.5%)	14 (45.2%)	10 (32.3%)
					NS	NS	NS	NS	NS	<0.05	NS
	−	42 ± 11	17 ± 12	70	26 (37.1%)	24 (34.3%)	24 (34.3%)	12 (17.1%)	2 (2.9%)	18 (25.7%)	20 (28.6%)
Control (*n* = 87)	+	45 ± 10	20 ± 10	14	3 (21.4%)	3 (21.4%)	3 (21.4%)	2 (14.3%)	0 (0%)	3 (21.4%)	2 (14.3%)
					NS	NS	NS	NS	NS	NS	NS
	−	39 ± 10	16 ± 10	23	4 (17.4%)	3 (13.0%)	3 (13.0%)	2 (8.7%)	0 (0%)	2 (8.7%)	1 (4.3%)

* Unless otherwise indicated, all values are shown as *n* (%).
† +, positive skin prick test; −, negative skin prick test.
‡ Age and exposure are presented as mean ± SD.

Cancer Rates in Paper Production vs Recycling

Risk of Cancer among paper recycling workers - Danish Cancer Society

The Journal for Occupational and Environmental Medicine. 1997 October; 54(10): 729–733.

The Study

- 5377 employees from five paper recycling plants were studied.
- These workers had been employed from 1965-1990, and the study followed up with them until 1994.

Results

- Pharyngeal Cancer
  SIR 3.33, 95% CI
- Lung Cancer
  SIR 1.21, 95% CI
- Hodgkin's Disease
  SIR 1.90, 95% CI

Particulates and Lung Function

Study on Occupational and Environmental Lung Disease - American College of Chest Physicians
Lung Function Among Workers In The Soft Tissue Paper-Producing Industry. Kraus T, Pfahlberg A, Zöbelein P, Gefeller O, Raithel H. *ChestJournal.org*

- **1,047 workers studied via Spirometry (FVC and FEV1) Results**
- **Controls: 189 Moderate Exposure: 240 High Exposure: 618**

Variables	Inhalable Dust, mg/m^3	Respirable Dust, mg/m^3	Fibers/m^3
Measurements, No.	148	33	95
Mean ± SD	12.4 ± 18.8	0.28 ± 0.38	420,000 ± 392,000
Minimum	0.04	< DL	< DL
Maximum	96.1	1.78	1,500,000
90% quantile	21.3	0.84	1,080,000

*DL = detection limit.

Additional Thoughts

- Amount of research
- Conflicting reports
- Social policy
- The sorting problem
- The digital age.

References

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Kraus T, Pfahlberg A, Zöbelein P, Gefeller O, Raithel H.
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B A Rix, E Villadsen, G Engholm, E Lynge.
Journal of Occupational & Environmental Medicine. 1997 October; 54(10): 729–733.

Thanks For Watching

Questions?