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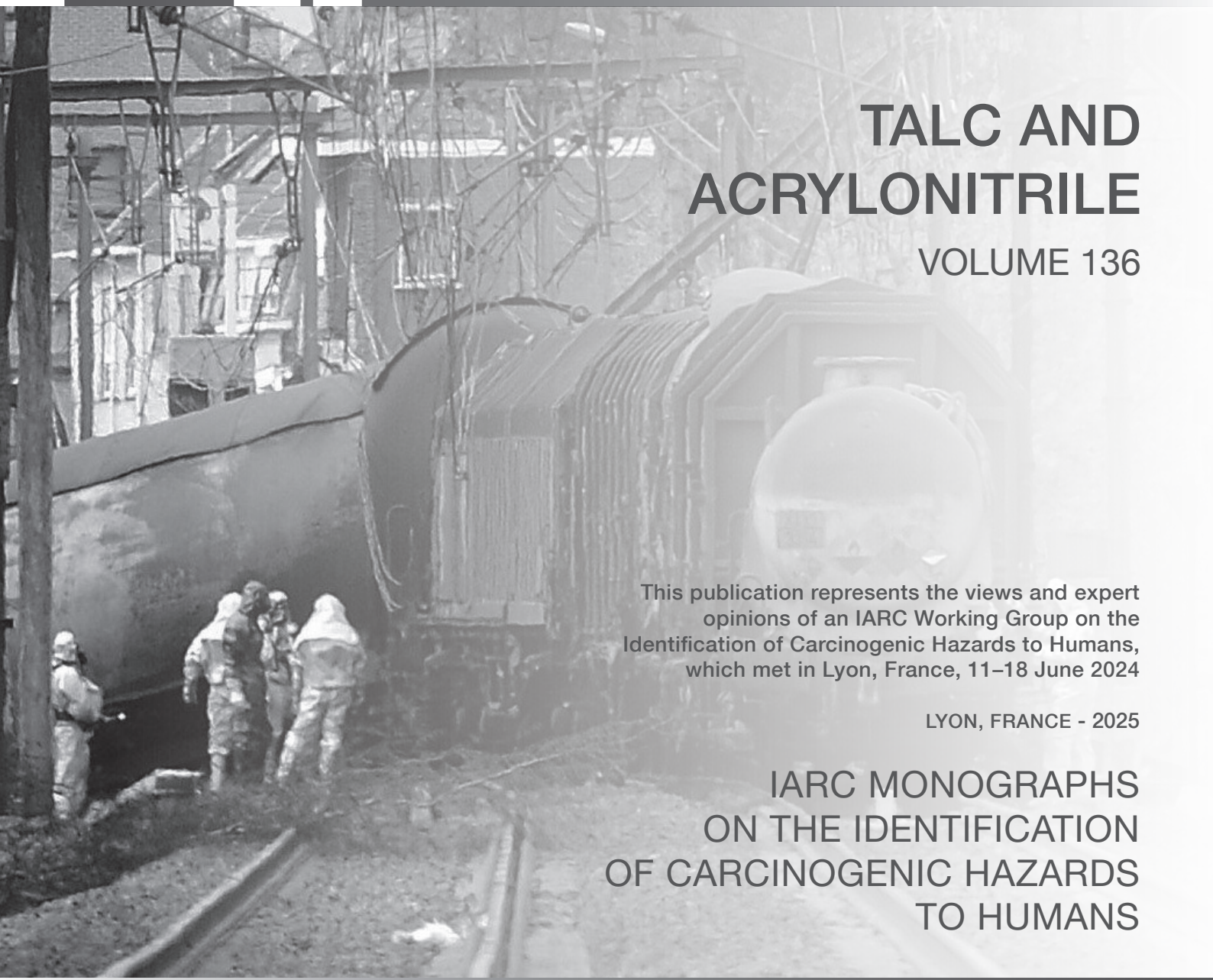

TALC AND ACRYLONITRILE

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International Agency for Research on Cancer

World Health Organization

Table S1.12 Dust measurements in talc mines and mills (liquid impinger, all values in mppcf)

Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
USA/NY (Gouverneur District)	NR	Mine	Driller	At BZ height	NR	1440		Dreessen (1933)
		Mill	Miller	At BZ height	NR	52		
			Other	At BZ height	NR	4		
USA/Georgia (Chatsworth)	–	Mine[a]	Driller	NR	3	855		Dreessen and DallaValle (1935)
			Mucker	NR	3	32		
		Mill	Sawyer	NR	5	324	2 sites	
			Crushermen	NR	3	85.6	2 sites	
			Packermen	NR	3	1672	2 sites	
			Packaging	NR	2	17.1	2 sites	
			Foremen	NR	1	162	2 sites	
USA/NY (Gouverneur District)	1940–1941	Mine A[a]	Drilling	NR	1	200	Upstream of drill	Siegal et al. (1943)
			Drilling	NR	1	300	Downstream of drill	
			Drilling	NR	1	75	Upstream (exhaust on)	
			Drilling	NR	1	110	Upstream (exhaust on)	
			Drilling	NR	1	600	Exhaust off	
			Drilling	NR	1	2700	Downstream, exhaust off	
			Drilling	NR	1	5000	At exhaust of dust collector	

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
			Drilling	NR	1	1500	At exhaust of dust collector after drilling	
			Drilling	NR	1	150	General air	
			Stoping	NR	1	4000	Dead end stope	
			Mucking	NR	1	40	Bottom of stope	
			Mucking	NR	1	50	Bottom of stope	
			Mucking	NR	1	6	Top of pile	
		Mine B[a]	Drilling	NR	1	65	Upstream of drill	
			Drilling	NR	1	265	Upstream turbulent air	
			Stoping	NR	1	760	Top of dead-end raise	
			Mucking	NR	1	35	Downstream of mucker	
			Mucking	NR	1	24	Downstream of mucker	
		Mine C[a]	Drilling	NR	1	90[c]	Dead end drift	
			Drilling	NR	1	300[c]	Just off main airway	
			Drilling	NR	1	16[c]	Main airway	
			Drilling	NR	1	100[c]	Breathing level (stope top)	
		Mills 1–3	Jaw crusher	NR	3	46 (20–76.5)		
		Mills 1, 2	Disc crusher	NR	2	50 (22–79)		
		Mills 1, 2	Pebble mill	NR	3	61 (32–106)		

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
		Mills 1, 2, 4	Bagging	NR	3	163 (141–190)	Paper bagging	
		Mills 1, 3, 5	Bagging	NR	4	93 (73.5–120)	Burlap bagging	
		Mills 1, 3–5	General air	NR	4	72 (48–85)	Cylinder room	
		Mills 4, 5	Separator		2	62 (58–67.5)	Separator room	
		Mill 1	Manual handling	NR	1	215		
USA/NY (Gouverneur District)	1941–1954	Mines[a]	Drilling	NR	3	818 (83–2800)	1941 (pre-control measures)	Kleinfeld et al. (1955)
				NR	3	3 (0–8)	1954 (post-control measures)	
			Mucking	NR	3	120 (2–475)	1941 (pre-control measures)	
				NR	3	4 (3–5)	1954 (post-control measures)	
			General air	NR	3	19 (4–36)	1941 (pre-control measures)	
		Mills	Crushing	NR	3	180 (22–690)	1941 (pre-control measures)	
				NR	3	63 (3–360)	1954 (post-control measures)	

Table S1.12 Dust measurements in talc mines and mills (liquid impinger, all values in mppcf)

Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
			Screening	NR	3	69 (43–136)	1941 (pre-control measures)	
				NR	3	37 (8–68)	1954 (post-control measures)	
			Grinding	NR	3	92 (32–271)	1941 (pre-control measures)	
				NR	3	20 (5–40)	1954 (post-control measures)	
			Separator	NR	3	278 (58–728)	1941 (pre-control measures)	
				NR	3	11 (3–21)	1954 (post-control measures)	
			Bagging	NR	3	151 (26–520)	1941 (pre-control measures)	
				NR	3	23 (5–90)	1954 (post-control measures)	
			Blow room	NR	3	1227 (115–2480)	Pre-1941 (discontinued)	
			Open chutes	NR	3	125 (21–440)	Pre-1941 (discontinued)	
			General air	NR	3	69 (65–85)	1941 (pre-control measures)	
				NR	3	19 (5–40)	1954 (post-control measures)	

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
USA/NY (Gouverneur District)	–	Mill	All	NR	NR	63.1	Fibrous talc	Kleinfeld et al. (1964)
				NR	NR	62.7	Granular talc	
USA/NY (Gouverneur District)	1940–1965	Mines[a]	Drilling	NR	3	818 (83–2800)	1945 (pre-control measures)	Kleinfeld et al. (1967)
				NR	3	5 (0–10)	1946–65 (post-control measures)	
			Mucking	NR	3	120 (2–475)	1945 (pre-control measures)	
				NR	3	5 (3–9)	1946–65 (post-control measures)	
			Scraping	NR	3	9 (5–13)	1946–65 (post-control measures)	
		Mills	Crushing	NR	3	180 (22–690)	1945 (pre-control measures)	
				NR	3	42 (3–360)	1946–65 (post-control measures)	
			Screening	NR	3	69 (43–136)	1945 (pre-control measures)	
				NR	3	37 (8–68)	1946–65 (post-control measures)	
			Milling	NR	3	92 (32–271)	1945 (pre-control measures)	

Table S1.12 Dust measurements in talc mines and mills (liquid impinger, all values in mppcf)

Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
				NR	3	25 (5–70)	1946–65 (post-control measures)	
			Separator	NR	3	278 (58–728)	1945 (pre-control measures)	
				NR	3	27 (5–60)	1946–65 (post-control measures)	
			Pulverizing	NR	3	28 (25–31)	1946–65 (post-control measures)	
			Bagging	NR	3	151 (26–520)	1945 (pre-control measures)	
				NR	3	27 (5–69)	1946–65 (post-control measures)	
			RR loading	NR	3	73 (18–169)	1946–65 (post-control measures)	
			Blow room	NR	3	1227 (115–2480)	Pre-1945 (discontinued)	
			Open chutes	NR	3	125 (21–440)	Pre-1945 (discontinued)	
USA/NY (Gouverneur District)	1954–1970	Mine[a]	Drilling	NR	NR	5	1954	Kleinfeld et al. (1973)
				NR	NR	5	1963	
				NR	NR	13	1969	
				NR	NR	7	1970	
			Dragline loading	NR	NR	7	1963	

Table S1.12 Dust measurements in talc mines and mills (liquid impinger, all values in mppcf)

Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
				NR	NR	10	1970	
			Tramming and mucking	NR	NR	29	1969	
				NR	NR	11	1970	
			1°Crushing	NR	NR	2	1954	
				NR	NR	26	1958	
				NR	NR	23	1963	
				NR	NR	18	1964	
				NR	NR	13	1969	
				NR	NR	48	1970	
			Hoist loading	NR	NR	70	1964	
				NR	NR	140	1969	
				NR	NR	14	1970	
		Mill	2°Crushing	NR	NR	12	1954	
				NR	NR	23	1958	
				NR	NR	8	1963	
				NR	NR	10	1964	
				NR	NR	12	1969	
				NR	NR	13	1970	
			Wheeler mill	NR	NR	15	1954	

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
				NR	NR	13	1958	
				NR	NR	5	1963	
				NR	NR	3	1964	
				NR	NR	11	1969	
				NR	NR	10	1970	
			Hardinge mill	NR	NR	18	1954	
				NR	NR	14	1958	
				NR	NR	4	1963	
				NR	NR	7	1964	
				NR	NR	8	1970	
			Bagging	NR	NR	25	1954	
				NR	NR	15	1958	
				NR	NR	5	1963	
				NR	NR	9	1964	
				NR	NR	4	1969	
				NR	NR	8	1970	
			Palletizing	NR	NR	40	1954	
				NR	NR	25	1964	
				NR	NR	10	1969	

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
				NR	NR	6	1970	
			Bulk loading	NR	NR	10	1970	
			Loading bags	NR	NR	109	1958	
				NR	NR	39	1963	
				NR	NR	31	1964	
				NR	NR	62	1970	
USA/NY (Gouverneur District)	NR	Mine[a]	Drilling	NR	NR	19	1966–69	Kleinfeld et al. (1974)
				NR	NR	7	1972	
			Mucking	NR	NR	9[b]	1966–69	
				NR	NR	3	1972	
		Mill	Crushing	NR	NR	28	1966–69	
				NR	NR	35	1972	
			Milling	NR	NR	40	1966–69	
				NR	NR	7	1972	
			Separator	NR	NR	13	1972	
			Bagging	NR	NR	29	1966–69	
				NR	NR	27	1972	
			Loading bags	NR	NR	43	1966–1969	
				NR	NR	36	1972	

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
USA/NY (Gouverneur District)	NR	Mine[a]	All	TWA_{8h}	13	10.5 (1.5–15.8)	Current study[d]	Dement and Zumwalde (1979)
		Mill	All	TWA_{8h}	19	2.9 (0.5–3.6)	Current study	
		Mine	Drilling	NR	NR	4	1972 (MESA)	
				NR	NR	5	1973 (MESA)	
				NR	NR	3	1975 (MESA)	
				NR	NR	12	1975 (NIOSH)	
			Dragling	NR	NR	8	1972 (MESA)	
				NR	NR	3	1973 (MESA)	
				NR	NR	5	1975 (MESA)	
				NR	NR	12	1975 (NIOSH)	
			Mucking	NR	NR	10	1972 (MESA)	
				NR	NR	3	1973 (MESA)	
				NR	NR	5	1975 (MESA)	
				NR	NR	10–15	1975 (NIOSH)	
			1 °Crushing	NR	NR	11	1972 (MESA)	
				NR	NR	5	1973 (MESA)	
				NR	NR	18	1975 (MESA)	
			Hoist loading	NR	NR	18	1972 (MESA)	
				NR	NR	10	1973 (MESA)	

Table S1.12 Dust measurements in talc mines and mills (liquid impinger, all values in mppcf)

Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
				NR	NR	15	1975 (MESA)	
				NR	NR	2	1975 (NIOSH)	
			2 °Crushing	NR	NR	3	1972 (MESA)	
				NR	NR	8	1973 (MESA)	
				NR	NR	3	1975 (MESA)	
				NR	NR	3	1975 (NIOSH)	
			Wheeler mill	NR	NR	4	1973 (MESA)	
				NR	NR	10	1975 (MESA)	
				NR	NR	3	1975 (NIOSH)	
			Hardinge mill	NR	NR	10	1975 (MESA)	
				NR	NR	3	1975 (NIOSH)	
			Bagging	NR	NR	8	1973 (MESA)	
				NR	NR	9	1975 (MESA)	
				NR	NR	4	1975 (NIOSH)	
			Palletizing	NR	NR	8	1973 (MESA)	
				NR	NR	15	1975 (MESA)	
				NR	NR	2	1975 (NIOSH)	
USA/NY (Gouverneur District)	NR	Mine[a]	Trammer	TWA_{8h}	3	10.1		NIOSH (1980)
			Scrapper man	TWA_{8h}	5	11.8		

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference
			Driller	TWA_{8h}	1	0.7		
			Mucker	TWA_{8h}	1	15.8		
			Cageman	TWA_{8h}	1	2.0		
			Repair helper	TWA_{8h}	1	3.6		
			Maintenance	TWA_{8h}	1	1.5		
		Mill	Foreman	TWA_{8h}	2	2.9		
			Labourer	TWA_{8h}	1	0.5		
			Crusher oper.	TWA_{8h}	4	2.6		
			Hardinge oper.	TWA_{8h}	2	3.4		
			Wheeler oper.	TWA_{8h}	2	3.1		
			Packer	TWA_{8h}	6	3.6		
			Packer svc.	TWA_{8h}	1	2.1		
			Fork lift oper.	TWA_{8h}	1	1.6		
Italy/Val Chisone	NR	Mill	NR	NR	NR	11		Rubino et al. (1979)
Norway	1960–1965	Mill	Bagging room	NR	NR	28.2		Wergeland et al. (2017)
			Sieving room		NR	150–200		
			Crushing		NR	2.6		
	From 1965		Unspecified		NR	1.3–393.3		

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Country/location (deposit)	Period	Site	Job	Sampling strategy information	No. of samples	Average (range) mppcf	Additional information	Reference

1°, primary; 2°, secondary; BZ, breathing zone; MESA, Mining Enforcement and Safety Administration report; mppcf, millions of particles per cubic foot of air; NIOSH, National Institute for Occupational Safety and Health; NR, not reported; NY, state of New York; oper., operator; svc., Service; TWA_{8h}, 8-hour time-weighted average; USA, United States of America.

[a] Underground mine.

[b] Median value.

[c] Single measurement.

[d] Refers to measurements in the cited study.

References

Dement JM, Zumwalde RD (1979). Occupational exposures to talcs containing asbestiform minerals. In: Lemen R, Dement JM, editors. Dusts and disease. Park Forest South (IL), USA: Pathotox Publishers; pp. 287–305.

Dreessen WC (1933). Effects of certain silicate dusts on the lungs. Archives of Environmental & Occupational Health. 15:66-78.

Dreessen WC, DallaValle JM (1935). The effects of exposure to dust in two Georgia talc mills and mines. Public Health Rep. 50(5):131–43. https://doi.org/10.2307/4581452

Kleinfeld M, Messite J, Kooyman O, Zaki MH (1967). Mortality among talc miners and millers in New York State. Arch Environ Health. 14(5):663–7. https://doi.org/10.1080/00039896.1967.10664815 PMID:6024643

Kleinfeld M, Messite J, Langer AM (1973). A study of workers exposed to asbestiform minerals in commercial talc manufacture. Environ Res. 6(2):132–43. https://doi.org/10.1016/0013-9351(73)90026-1 PMID:4713673

Kleinfeld M, Messite J, Shapiro J, Kooyman O, Swencicki R (1964). Lung function in talc workers: a comparative physiologic study of workers exposed to fibrous and granular talc dusts. Arch Environ Health. 9(5):559–66. https://doi.org/10.1080/00039896.1964.10663880 PMID:14195257

Kleinfeld M, Messite J, Tabershaw IR (1955). Talc pneumoconiosis. AMA Arch Ind Health. 12(1):66–72. PMID:14387310

Kleinfeld M, Messite J, Zaki MH (1974). Mortality experiences among talc workers: a follow-up study. J Occup Med. 16(5):345–9. PMID:4826349

14 NIOSH (1980). Occupational exposure to talc containing asbestos. Prepared by Dement JM, Zumwalde RD, Gamble JF, Fellner W, DeMeo MJ, Brown DP, et al. Technical report.
15 DHEW (NIOSH) Publ. No. 80-115. Cincinnati (OH), USA: National Institute for Occupational Safety and Health.

16 Rubino GF, Scansetti G, Piolatto G (1979). Mortality and morbidity among talc miners and millers in Italy. In: Lemen R, Dement JM, editors. Dusts and disease. Park Forest South (IL),
17 USA: Pathotox Publishers; pp. 357–63.

18 Siegal W, Smith AR, Greenburg L (1943). The dust hazard in tremolite talc mining, including roentgenological findings in talc workers. Am J Roentgenol Radium Ther. 49:11–29.

19 Wergeland E, Gjertsen F, Vos L, Grimsrud TK (2017). Cause-specific mortality and cancer morbidity in 390 male workers exposed to high purity talc, a six-decade follow-up. Am J
20 Ind Med. 60(9):821–30. https://doi.org/10.1002/ajim.22749 PMID:28745030