United States
Environmental Protection Agency

Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for Asbestos Part 1: Chrysotile Asbestos

Systematic Review Supplemental File:

Data Quality Extraction of Environmental Fate and Transport Studies

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Table 1. Other Fate Endpoints Study Summary for Chrysotile Asbestos

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non guideline, experimental study; the effect of lichen colonization on chrysotile structure is investigated by analyzing the composition of both colonized and uncolonized field samples. The effect of oxalic acid exposure on chrysotile structure is also investigated at various concentrations.	Chrysotile fibers were incubated in oxalic acid solutions for 35 days to observe its effect on MgO content. Chrysotile (both uncolonized or colonized by lichens) from 3 serpentinite outcrops and one asbestos cement roof were collected.	In the three asbestos outcrops and asbestos-cement roof, MgO content (wt %) was lower by 15-20% in lichen colonized chrysotile than in uncolonized chrysotile. Incubation in 50 mM oxalic acid transformed chrysotile fibers into "an amorphous powdery material, consisting mainly of pure silica", and without fibrous nature.	The reviewer agreed with this study's overall quality level.	(Favero-Longo et al., 2005, 3520647)	High
Non guideline, experimental study; oxalic acid and citric acid leaching of asbestos rich sediment	Chrysotile asbestos rich sediment and a serpentine bedrock sample underwent leaching in 0.025 M oxalic acid and 0.017 M citric acid. Total elemental analysis was performed using inductively coupled plasma spectrometry (ICPS), individual fiber analysis was done using energy dispersive x-ray analysis (EDX) and a scanning and transmission electron microscope (STEM).	ICPS results showed citric acid was slightly more effective at removing most metals from the sediment samples than oxalic acid; however, EDX analysis of individual fibers showed Mg/Si ratios were reduced from 0.68-0.69 to 0.07 by oxalic acid and only to 0.38 by citric acid.	The reviewer agreed with this study's overall quality level.	(Schreier et al., 1987, 1917037)	High

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non-guideline, experimental study; decomposition study of asbestos in 25% acid or caustic solutions	Chrysotile, crocidolite, amosite, anthophyllite, actinolite, and tremolite asbestos fibers were dissolved in 25% acid or NaOH solution	Degradation in 25% HCl, acetic acid, H_3PO_4, H_2SO_4 and NaOH, respectively was reported for Chrysotile (55.69, 23.42, 55.18, 55.75 and 0.99%), Crocidolite (4.38, 0.91, 4.37, 3.69 and 1.35%), Amosite (12.84, 2.63, 11.67, 11.35 and 6.97%), Anthophyllite (2.66, 0.60, 3.16, 2.73 and 1.22%), Actinolite (20.31, 12.28, 20.19, 20.38 and 9.25%) and Tremolite (4.77, 1.99, 4.99, 4.58 and 1.80%).	Due to limited information assessing the results were challenging.	(Speil and Leineweber, 1969, 5353620)	Unacceptable

Table 2. Hydrolysis Study Summary for Chrysotile Asbestos

Study Type (year)	pH	Temperature	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non-guideline, experimental study; dissolution of chrysotile and crocidolite asbestos in water at various pH and temperatures.	7, 7, 7, 9, and 4 for experiments 1-5, respectively	44, 6, 25, 25, and 25°C for experiments 1-5, respectively	170 or 1024 hours	170-hour study results evaluating Mg removal from Chrysotile (proportion of 1 layer): Experiments 1-4: 0.32-0.94. Experiment 5 (pH 4, 25°C): 8.84 170-hour study results evaluating Si removal from Chrysotile (proportion of 1 layer): Experiments 1-4: 0.5-0.25.	The reviewer agreed with this study's overall quality level.	(Gronow, 1987, 5353542)	High

Study Type (year)	pH	Temperature	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
				Experiment 5: 5.05. 170-hour study results evaluating Mg removal from Crocidolite (proportion of 1 layer): Experiments 1-5: 0.42-1.80. 170-hour study results evaluating Si removal from Crocidolite (proportion of 1 layer): 0.03-0.56. 1024-hour results (proportion of one layer removed) for experiment 3 only: Chrysolite, Mg: 0.94; Si: 0.36 Crocidolite, Mg: 1.42; Si: 0.37			
Non-guideline; dissolution study; sample size, temperature and pH evaluated; pH change over time compared for asbestos minerals, amosite and crocidolite and chrysotile	5.9-6.1 (initial)	5 to 45 °C	20 min; 1000 hours	Rate of dissolution is a function of surface area and temperature. Mg^{2+} may be continuously liberated from fibers leaving a silica skeleton. The rate-controlling step was determined to be removal of brucite layer. Smaller particles liberated more magnesium	The reviewer agreed with this study's overall quality level.	(Choi and Smith, 1972, 4140459)	High
Non guideline;	Not reported	Not reported but	3-5 days	Chrysotile in	The	(Bales	High

Study Type (year)	pH	Temperature	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
experimental study; a particle electrophoresis apparatus was used to monitor absorption properties of chrysotile asbestos aging in water	but held constant	held constant		natural water acquires a negative surface charge by rapid adsorption of natural organic matter (<1 day). Positively charged >Mg-OH^{2+} sites are removed by dissolution in the outer brucite sheet resulting in exposure of underlying >SiO^- sites.	reviewer agreed with this study's overall quality level.	and Morgan, 1985, 3582724)	

Table 3. Aquatic Bioconcentration Study Summary for Chrysotile Asbestos

Study Type (year)	Initial Concentration	Species	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non-guideline; experimental study; uptake monitoring of chrysotile asbestos in Coho and juvenile green sunfish	1.5×10^6 and 3.0×10^6 fibers/L	Coho salmon (*Oncorhynchus kisutch*) and juvenile green sunfish (*Lepomis cyanellus*)	Coho salmon: 86 and 40 days; Green sunfish: 67 and 52 days	Asbestos fibers were found in the asbestos-treated fish by transmission electron microscopy (TEM); however total body burdens were not calculated. Sunfish lost scales and had epidermal tissue erosion. Asbestos fibers were not identified in control or blank samples.	The reviewer agreed with this study's overall quality level.	(Belanger et al., 1986c, 3584231)	High
Non-guideline; experimental study; uptake monitoring of chrysotile by Asiatic clams	2.5×10^8 - 8.8×10^9 fibers/L	Asiatic clams (*Corbicula* sp.)	96-hours and 30-days	Chrysotile asbestos was detected in clams at 69.1±17.1 fibers/mg whole body homogenate after 96 hours of exposure to 10^8 fibers/L and food. Chrysotile asbestos was detected in clams after 30 days of exposure to 10^8 fibers/L at 147.3±52.6 fibers/mg dry weight gill tissue and 903.7±122.9 fibers/mg dry weight visceral	The reviewer agreed with this study's overall quality level.	(Belanger et al., 1986b, 3093600)	High

				tissue. Chrysotile asbestos was not detected in clams after 96 hours at all asbestos exposure concentrations tested with no food.			
Non-guideline; experimental study; measuring uptake of chrysotile asbestos by Asiatic clams	0, 10^4, and 10^8 fibers/L	Asiatic clams (*Corbicula* sp., collected in winter and summer)	30-days	Fibers were not detected in clams from blank control groups and after exposure to 10^4 fiber/L groups for 30 days. Asbestos concentration in tissue after exposure to 10^8 fiber/L for 30 days (fibers/mg dry weight tissue) in winter samples: Gills: 132.1±36.4; Viscera: 1055.1±235.9 and summer samples: Gill: 147.5±30.9; Viscera: 1127.4±190.2.	The reviewer agreed with this study's overall quality level.	(Belanger et al., 1986a, 3093856)	High
Non-guideline; experimental study; BCF determination of chrysotile asbestos in the Asiatic clam	0, 10^4, and 10^8 fibers/L	Asiatic clam (*corbicula* sp.)	30 day and field exposed	BCF = 0.308 in gill tissue, 1.89 in viscera tissue, and 1.91 in whole clam homogenates after 30-days exposure to 10^8 fibers/L. Field exposed BCFs = 0.16-0.19 in gills, 64.9-102 in viscera, 1,442-5,222 in whole clams.	The reviewer agreed with this study's overall quality level.	(Belanger et al., 1987, 3584230)	High
Non-guideline; experimental study; chrysotile	$5.1±2.8×10^6$, $7.6±8.1×10^8$ fibers/L	Japanese Medaka (*Oryzias latipes*)	13 weeks	After 28 days of exposure to chrysotile asbestos at 10^{10} fibers/L	The reviewer agreed with this study's overall	(Belanger et al., 1990, 3585046)	High

asbestos uptake study in Japanese Medaka				concentrations, fish total body burden was 375.7 fibers/mg. After 3 months of exposure to chrysotile asbestos at 10^8 fibers/L concentrations, fish total body burden was 486.4±47.9 fibers/mg.	quality level.		

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