

Data Quality Evaluation Information for Environmental Hazard for Asbestos Part 2 – Supplemental Evaluation Including Legacy Uses and Associated Disposals of Asbestos

Systematic Review Support Document for the Risk Evaluation

CASRN: 1332-21-4

November 2024

This supplemental file contains information regarding the data quality evaluation results relevant to the characterization of environmental hazard for the *Risk Evaluation for Asbestos Part 2: Supplemental Evaluation Including Legacy Uses and Associated Disposals of Asbestos.* For the human health assessment in Asbestos Part 2, EPA focused on epidemiological evidence, therefore studies using human health animal models were considered for the characterization of environmental hazard for terrestrial mammalian wildlife populations.

EPA conducted data quality evaluation based on author-reported descriptions and results; additional analyses (*e.g.*, statistical analyses performed during data integration into the risk evaluation) potentially conducted by EPA are not contained in this supplemental file. EPA used the TSCA systematic review process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances* (also referred to as the '2021 Draft Systematic Review Protocol'). Any updated steps in the systematic review process since the publication of the 2021 Draft Systematic Review Protocol are described in the *Risk Evaluation for Asbestos Part 2: Supplemental Evaluation Including Legacy Uses and Associated Disposals of Asbestos – Systematic Review Protocol*.

Different data quality evaluation forms were used depending on the organism as described in the PECO statement in Appendix H.5.7 of the 2021 Draft Systematic Review Protocol. Each health outcome was evaluated independently within a given reference; therefore, each reference may have more than one overall quality determination (OQD) to more appropriately reflect the quality of each health outcome and the respective hazard endpoints as described by the study authors. Some data evaluation forms have general additional comments presented adjacent to the OQD to add further context. No OQD is determined for each reference as a whole, if it contains data from more than one evidence stream. The table of contents lists references based on broad habitat (*e.g.*, aquatic, terrestrial), taxa, taxonomic group, exposure duration, and health outcome (*e.g.*, mortality) categories relevant to the endpoint being evaluated.

Table of Contents

HERO ID	Reference	Page
Habitat: Aquatic (fr	eshwater)	
Taxa: Vertebrates		
Lepomis cyanellus		
3584231	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and pathological stress. Environmental Research 39(1):74-85.	7
Oncorhynchus kisutch		
3584231	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and pathological stress. Environmental Research 39(1):74-85.	11
Oryzias latipes		
3585046	Belanger, S. E., Cherry, D. S., Cairns, J. (1990). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.	25
4350438	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.	33
3585046	Belanger, S. E., Cherry, D. S., Cairns, J. (1990). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.	39
Pimephales promelas		
4350438	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.	49
4350438	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.	57
Poecilia formosa		
3582159	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment International 9(3):173-176.	71
Taxa: Invertebrates		
Corbicula fluminea		
3093856	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.	81
Corbicula sp.		

Asbestos	Table of Contents	
3093600	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian Journal of Fisheries and Aquatic Sciences 43(1):43-52.	93
3093600	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian Journal of Fisheries and Aquatic Sciences 43(1):43-52.	103
3584230	Belanger, S. E., Cherry, D. S., Cairns, J., Mcguire, M. J. (1987). Using Asiatic clams as a biomonitor for chrysotile asbestos in public water supplies. Journal of the American Water Works Association 79(3):69-74.	107
3093600	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian Journal of Fisheries and Aquatic Sciences 43(1):43-52.	109
Taxa: Plants (Vascu	lar)	
Lemna gibba		
3080106	Trivedi, A. K., Ahmad, I., Musthapa, M. S., Ansari, F. A., Rahman, Q. (2004). Environmental contamination of chrysotile asbestos and its toxic effects on growth and physiological and biochemical parameters of Lemna gibba. Archives of Environmental Contamination and Toxicology 47(3):281-289.	121
Habitat: Terrestria	1	
Taxa: Vertebrates		
Cavia porcellus		
1797399	Saxena, K. C., Srivastava, L., Dogra, R. K. (1982). Biochemical and histopathological response to chrysotile ingestion in guinea pigs. Industrial Health 20(1):19-25.	125
1060372	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel. Environmental Research 12(2):139-143.	129
Gallus gallus domesti	icus	
3664651	Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.	137
Mesocricetus auratus		
3615254	Pelfrene, A. F. (1977). Early vascular modifications induced by asbestos fibers in the hamster cheek pouch. Microvascular Research 13(2):261-266.	152
709665	Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden hamsters. Environmental Health Perspectives 53:25-Nov.	158
3581049	Smith, W. E., Hubert, D. D., Sobel, H. J., Peters, E. T., Doerfler, T. E. (1980). Health of experimental animals drinking water with and without amosite asbestos and other mineral particles. Journal of Environmental Pathology and Toxicology 3(5-6):277-300.	176
Mus musculus		
182	Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.	182

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Asbestos	Table of Contents	
758926	Haque, A. K., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chrysotile asbestos fibers detected in the newborn pups following gavage feeding of pregnant mice. Journal of Toxicology and Environmental Health, Part A: Current Issues 62(1):23-31.	192
182	Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.	200
6867451	Craighead, J. E., Richards, S. A., Calore, J. D., Fan, H., Weaver, D. L. (1993). Genetic factors influence malignant mesothelioma develop- ment in mice. European Respiratory Review, vol. 3, review no. 11 :118-120.	208
3617192	Lynch, K. M., Mciver, F. A., Cain, , J. R. (1957). Pulmonary tumors in mice exposed to asbestos dust. AMA Archives of Industrial Health 15(3):207-214.	212
	Rattus norvegicus	
112	Jacobs, R., Humphrys, J., Dodgson, K. S., Richards, R. J. (1978). Light and electron microscope studies of the rat digestive tract following prolonged and short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453.	215
3584909	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.	217
3615355	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.	249
3101157	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.	285
3616802	Donham, K. J., Berg, J. W., Will, L. A., Leininger, J. R. (1980). The effects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5 Suppl):1073-1084.	301
3619879	Engelbrecht, F. M., Burger, B. F. (1973). Biological effect of asbestos dust on the peritoneal viscera of rats. South African Medical Journal 47(38):1746-1750.	311
478543	Hasanoglu, H. C., Bayram, E., Hasanoglu, A., Demirag, F. (2008). Orally ingested chrysotile asbestos affects rat lungs and pleura. Archives of Environmental and Occupational Health 63(2):71-75.	315
3098168	Hilding, A. C., Hilding, D. A., Larson, D. M., Aufderheide, A. C. (1981). Biological effects of ingested amosite asbestos, taconite tailings, diatomaceous earth and Lake Superior water in rats. Archives of Environmental Health 36(6):298-303.	319
112	Jacobs, R., Humphrys, J., Dodgson, K. S., Richards, R. J. (1978). Light and electron microscope studies of the rat digestive tract following prolonged and short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453.	323
709664	Mcconnell, E. E., Rutter, H. A., Ulland, B. M., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats. Environmental Health Perspectives 53:27-44.	325
3613439	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology Program Technical Report Series 280:1-178.	335
758884	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.	345
758961	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).	361

759022	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90:127-133.	371
3612470	Will, L. A., Leininger, J. R., Donham, K. J. (1979). Regurgitation and choke in rats. Laboratory Animal Science 29(3):360-363.	377
Taxa: Invertebrates		
Lumbriculus rubellus		
3583167	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.	381
3583167	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.	396

Study Citation:			86). Effects of chrysot	le asbestos on coho salmon and green sunfish: evidence of behavioral and
Duration:		stress. Environmental Research $39(1)$:74-85. ation: > 21 days; Exposure Duration: > 21 da	WC .	
Exposure Route,				interest in exposure water, but unable to determine exact uptake route)
Media, Path:	Aquatic (IIC	sitwater), water, Not determined by study aut	nors (i.e., chemical of	increst in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate: F	Fish; Lepomis cyanellus; Juvenile		
Health Outcome:	Behavioral	ish, <i>Expontis cyunettus</i> , suvenite		
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3584231	erpentine) (CASKIV 12001-29-5)		
	5504251			
Domain		Metric	Rating	Comments
Domain 1: Test Substan			Ŧ	
	Metric 1:	Test Substance Identity	Low	The Chemical was identified by name only.
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity was analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
U	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The control group had a high mortality of 25%.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media	Medium	The study provided only limited details on the measures taken to appropriately prepare
		Preparation		test concentrations (used sonification).
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.
	M	Administration	т	
	Metric 9:	Measurement of Test Substance	Low	Measurements were not reported.
	Metric 10:	Concentration Exposure Duration and Frequency	Low	The high concentration was exposed for a shorter duration. It a long duration to not feed the fish.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were adequate to addres the purpose of the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
		· · ·		
Domain 4: Test Organis				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the original source (holding pond) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	Replicates were not reported.
		Replicates per Group		

Domain 5: Outcome Assessment

Continued on next page ...

			continued from previous pa	ge		
Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and					
	pathological stress. Environmental Research 39(1):74-85.					
Duration:		ation: > 21 days; Exposure Duration: > 21				
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e., chemical of inter	est in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Vertebrate; Fish; <i>Lepomis cyanellus</i> ; Juvenile					
Health Outcome:	Behavioral					
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	3584231					
Domain		Metric	Rating	Comments		
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
	Metric 17:	Outcome Assessment Methodology	High	Mortalities were checked twice a day.		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	/ Variable Co	ntrol				
-	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Presenta	ation and Anal	ysis				
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not shown for each treatment and control group		
	Metric 23:	Explanation of Unexpected Outcomes	Low	There was incomplete reporting, so unexpected outcomes were not addressed.		
Additional Comments:	Results were	not quantified (page 10).				
Overall Qualit	v Detern	nination	Uninformative			

Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and					
Derestian	pathological stress. Environmental Research 39(1):74-85. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Duration:						
Exposure Route,	Aquatic (fre	snwater); water; Not determined by study a	authors (1.e., chen	nical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:	Vantabuata. I	Tish, Langunia gugu alluar Investila				
Taxa, Species, Age:		Fish; Lepomis cyanellus; Juvenile				
Health Outcome:	Mortality	() (CAGDNI 10001 00 5)				
Chemical:		erpentine) (CASRN 12001-29-5)				
HERO ID:	3584231					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.		
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity was analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.		
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.		
Domain 2: Test Design	34.1.4		*** *			
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Low	The control group had a high mortality of 25%.		
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.		
Domain 3: Exposure Ch	aracterization					
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).		
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.		
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.		
	Metric 10:	Concentration Exposure Duration and Frequency	Low	The high concentration was exposed for a shorter duration. This was a long duration to not feed the fish.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were adequate to address the purpose of the study.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.		
Domain 4: Test Organis						
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the original source (holding pond)of the test organ- isms.		
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Replicates were not reported.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
		Conti	inued on next pa	Ige		
		Contr	inued on next pa	ge		

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cal stress. Environmental Research $39(1)$:74-8 Duration: > 21 days; Exposure Duration: > 21	5. days	chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and nical of interest in exposure water, but unable to determine exact uptake route) <u>Comments</u> Mortalities were checked twice a day. Outcomes were assessed consistently across study groups.
freshwater); Water; Not determined by study a e; Fish; <i>Lepomis cyanellus</i> ; Juvenile e (serpentine) (CASRN 12001-29-5) <u>Metric</u> 2: Outcome Assessment Methodology 3: Consistency of Outcome <u>Assessment</u>	uthors (i.e., cher Rating High	Comments Mortalities were checked twice a day.
e; Fish; <i>Lepomis cyanellus</i> ; Juvenile e (serpentine) (CASRN 12001-29-5) <u>Metric</u> 2: Outcome Assessment Methodology 3: Consistency of Outcome <u>Assessment</u>	Rating High	Comments Mortalities were checked twice a day.
e (serpentine) (CASRN 12001-29-5) Metric Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
e (serpentine) (CASRN 12001-29-5) Metric Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
e (serpentine) (CASRN 12001-29-5) Metric 7: Outcome Assessment Methodology 8: Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
Metric 2: Outcome Assessment Methodology 3: Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
7: Outcome Assessment Methodology 8: Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
7: Outcome Assessment Methodology 8: Consistency of Outcome Assessment	High	Mortalities were checked twice a day.
8: Consistency of Outcome Assessment	-	
Assessment	High	Outcomes were assessed consistently across study groups.
Control		
	Low	
8	Low	The study did not provide enough information to allow a comparison of environmental conditions.
	High	There were no differences among groups.
nalvaia		
5	Low	It was not along if statistical analysis was nonformed, but you dots was generated
		It was not clear if statistical analysis was performed, but raw data was reported.
	-	Data for exposure-related findings were presented for each treatment and control group
b. Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.
	Design and Procedures	Design and Procedures 0: Outcomes Unrelated to Exposure High Analysis 1: Statistical Methods Low 2: Reporting of Data High 3: Explanation of Unexpected Outcomes Medium

Study Citation:				chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and			
Duration		stress. Environmental Research $39(1):74-8$					
Duration:		ation: > 21 days; Exposure Duration: > 21					
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:	Vantabuatas I	Fish Anoshinghus bigutaly Embryo					
Taxa, Species, Age:		Fish; Oncorhynchus kisutch; Embryo					
Health Outcome:	Behavioral						
Chemical: HERO ID:	3584231	erpentine) (CASRN 12001-29-5)					
Domain	5504251	Metric	Rating	Comments			
Domain 1: Test Substan	22	Metric	Katilig	Comments			
Domain 1. Test Substan	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing labo-			
	Metric 2.	Test Substance Source	Low	ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.			
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.			
Domain 2. Tast D							
Domain 2: Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	There was a high control mortality of 19%, but the behavioral response was suitable.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
	incure of		Low	resourchers and not report now organisms were anotated to study groups.			
Domain 3: Exposure Ch	aracterization						
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.			
		Administration	_				
	Metric 9:	Measurement of Test Substance	Low	Measurements were not reported.			
	Metric 10:	Concentration Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).			
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.			
	Methe II.	Spacing of Exposure Levels	10/21	Only the concentration was tested.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organis	m						
Domain 1. 10st Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source			
	Metric 13.	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			
	Meule 14.	Conditions	Ingn	An proceament conditions were the same for conditionand exposed organisms.			
	Metric 15:	Number of Organisms and	Low	Replicates were not reported.			
		Replicates per Group		1 1			
Domain 5: Outcome As			_				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.			
		a	nued on next pa				

Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral ar					
study chatton.	pathological stress. Environmental Research 39(1):74-85.					
Duration:		ation: > 21 days; Exposure Duration: > 21				
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e., chemi	cal of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Vertebrate; F	Fish; Oncorhynchus kisutch; Embryo				
Health Outcome:	Behavioral					
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)				
HERO ID:	3584231					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	High	The response to TMS treatment was assessed.		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	Variable Co	atrol				
Domain 0. Confounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	Wietric 19.	Design and Procedures	LOW	conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups, but few details were provided.		
Domain 7: Data Present	ation and Anal					
Domain 7. Data Fresent	Metric 21:	Statistical Methods	Low	Statistical analysis was reported but not described adequately.		
	Metric 21: Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group		
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.		
	Metric 25:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					
Overall Qualit	v Dotorn	nination	Medium			

Asbestos

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Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral ar				
Duration:		stress. Environmental Research $39(1)$:74-8 ation: > 21 days; Exposure Duration: > 21			
Exposure Route,				nical of interest in exposure water, but unable to determine exact uptake route)	
Media, Path:	Aquatic (ires	sinwater), water, not determined by study a	uniors (i.e., chen	incar of interest in exposure water, but unable to determine exact uptake route)	
Taxa, Species, Age:	Vertebrate: F	Fish; Oncorhynchus kisutch; Embryo			
Health Outcome:	Developmen				
Chemical:	•	erpentine) (CASRN 12001-29-5)			
HERO ID:	3584231				
Domain		Metric	Rating	Comments	
Domain 1: Test Substanc					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.	
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.	
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.	
Domain 2: Test Design					
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.	
	Metric 5:	Negative Control Response	Low	There was a high control mortality of 19%	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.	
Domain 2: Exposure Ch	reatorization				
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Medium	The study provided only limited details on the measures taken to appropriately prepare	
		Preparation	1110010111	test concentrations (used sonification).	
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.	
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.	
	Metric 10:	Concentration Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).	
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.	
		Spacing of Exposure Levels		,	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.	
Domain 4: Test Organisn	n				
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.	
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.	
	M . 1 17	Conditions	T		
	Metric 15:	Number of Organisms and	Low	Replicates were not reported.	
		Replicates per Group			
Domain 5: Outcome Ass					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.	
	Metric 17:	Outcome Assessment Methodology	High	The response to the TMS treatment was assessed.	
			nued on next pa		

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Study Citation:	Balangar S	E Schurr K Allen D I Cohara A E (1	086) Effects of	chrysotile aspectos on coho salmon and green sunfish, evidence of behavioral and			
Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and pathological stress. Environmental Research 39(1):74-85.						
Duration:		ation: > 21 days; Exposure Duration: > 21					
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:	1, (
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Embryo						
Health Outcome:	Developmen	nt/Growth					
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	3584231						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	v / Variable Co	ntrol					
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures		conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Low	There were no differences among groups, but few details were provided.			
Domain 7: Data Present	ation and Anal	veic					
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was reported but not described adequately.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Oveli	w Dotow	nination	Madium				
Overall Qualit	ly Deleri	manon	Medium				

Duration: > 2 (freshwater); te; Fish; Onco y le (serpentine : Test So : Test So : Test So : Test So : Negati : Negati : Rando ion	nvironmental Research 39(1):74-8 21 days; Exposure Duration: > 21 Water; Not determined by study a orhynchus kisutch; Embryo) (CASRN 12001-29-5) Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response mized Allocation	days	nical of interest in exposure water, but unable to determine exact uptake route) Comments The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%. Researchers did not report how organisms were allocated to study groups.
(freshwater); te; Fish; Onco y le (serpentine : Test So : Test So : Test So : Test So : Negati : Negati : Rando tion	Water; Not determined by study a orhynchus kisutch; Embryo) (CASRN 12001-29-5) Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Rating Low Low Low High Low	Comments The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
te; Fish; Onco y le (serpentine : Test So : Test So : Test So : Test So : Negati : Negati : Rando cion	orhynchus kisutch; Embryo) (CASRN 12001-29-5) Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Rating Low Low Low High Low	Comments The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
y le (serpentine : Test Si : Test Si : Test Si : Negati : Negati : Rando cion) (CASRN 12001-29-5) Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
y le (serpentine : Test Si : Test Si : Test Si : Negati : Negati : Rando cion) (CASRN 12001-29-5) Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
le (serpentine : Test Si : Test Si : Test Si : Test Si : Negati : Negati : Rando cion	Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
: Test Si : Test Si : Test Si : Negati : Negati : Rando cion	Metric ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
: Test Si : Test Si : Test Si : Negati : Negati : Rando	ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
:: Test So :: Test So :: Negati :: Negati :: Rando cion	ubstance Identity ubstance Source ubstance Purity ive Controls ive Control Response	Low Low Low High Low	The chemical was identified by name only. It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
:: Test So :: Test So :: Negati :: Negati :: Rando cion	ubstance Source ubstance Purity ive Controls ive Control Response	Low Low High Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
:: Test So :: Test So :: Negati :: Negati :: Rando cion	ubstance Source ubstance Purity ive Controls ive Control Response	Low Low High Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
: Test Si : Negati : Negati : Rando	ubstance Purity ive Controls ive Control Response	Low High Low	ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text. Purity and/or grade of the test substance were not reported. Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
:: Negati : Negati : Rando	ive Controls ive Control Response	High Low	Study authors reported using an appropriate concurrent negative control group. There was high control mortality of 19%.
: Negati : Rando	ive Control Response	Low	There was high control mortality of 19%.
: Negati : Rando	ive Control Response	Low	There was high control mortality of 19%.
: Negati : Rando	ive Control Response	Low	There was high control mortality of 19%.
: Rando	-		
ion			
: Experi Prepar	imental System/Test Media	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).
: Consis	stency of Exposure	High	Exposures were administered consistently across study groups in a static situation.
: Measu	nistration rement of Test Substance	Low	Measurements were not reported.
	ntration ure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	er of Exposure Groups/	N/A	Only one concentration was tested.
	ng of Exposure Levels g at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
3: Test O	rganism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	-	High	All pretreatment conditions were the same for control and exposed organisms.
5: Numb	er of Organisms and	Low	Replicates were not reported.
6: Adequ	acy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
7. Out	me Assessment Methodology	High	Mortalities were checked twice a day.
1	14: Acclir Condi 15: Numb Replic	 14: Acclimatization and Pretreatment Conditions 15: Number of Organisms and Replicates per Group 16: Adequacy of Test Conditions 	14: Acclimatization and Pretreatment High Conditions Conditions Low 15: Number of Organisms and Low Replicates per Group Low Low

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Study Citation:	Belanger S	E Schurr K Allen D I Gohara A E (19	986) Effects of	chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and			
Study Citation.	•	stress. Environmental Research 39(1):74-85		en ysome assestos on cono sannon and green sunnsn. evidence or benaviorar an			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,				nical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Embryo						
Health Outcome:	Mortality						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	3584231						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	y / Variable Co	ntrol					
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures		conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present		-					
	Metric 21:	Statistical Methods	Low	Statistical analysis was not reported, but raw data was available.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
	D .4.		M. J.				
Overall Qualit	ty Detern	nination	Medium				

Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Juvenile
Health Outcome:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain		Metric	Rating	Comments
Domain 1: Test Substar			_	
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
2 oniani 21 Teor 2 eorgi	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	There was a high control mortality of 13%. The assessed response was not thoroughly reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cl	naracterization			
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.
	Metric 10:	Concentration Exposure Duration and Frequency	Low	Study authors reported a long duration (40 days).
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4. Test Organic				
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Conditions Number of Organisms and	Low	Replicates were not reported.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	Medium	Not all fish were examined.
		Cont	tinued on nex	t page

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		contin	nued from p	previous page				
Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and							
Destin	pathological stress. Environmental Research 39(1):74-85.							
Duration: Exposure Route,	Overall Duration: > 21 days; Exposure Duration: > 21 days A quetie (frequencies): Weter: Net determined by study outbors (i.e., sherrise) of interest in exposure water, but weekle to determine exact writely route)							
Media, Path:	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Juvenile							
Health Outcome:	,	-Cancer/Carcinogenesis-Developmental and	d iuvenile to	xicology				
Chemical:		erpentine) (CASRN 12001-29-5)						
HERO ID:	3584231							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome Assessment	Medium	It was unclear if outcomes were assessed consistently across study groups.				
Domain 6: Confounding	g / Variable Co	ntrol						
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Low	There were no differences among groups, but few details were provided.				
Domain 7: Data Present	ation and Anal	vsis						
	Metric 21:	Statistical Methods	N/A	The study focused on pathology findings.				
	Metric 22:	Reporting of Data	Low	Data were only reported for some outcomes.				
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.				
Additional Comments:	None							
Overall Qualit	ty Deterr	nination	Low					

Asbestos

Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral an pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Embryo
Health Outcome:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	There was a high control mortality of 19%. The assessed response was not clearly re- ported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain 5. Exposure Cr	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.
	Metric 10:	Concentration Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Conditions Number of Organisms and	Low	Replicates were not reported.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	Medium	Not all fish were examined.
		Cont	tinued on nex	t page

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		conti	nued from p	previous page			
Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and						
	pathological stress. Environmental Research 39(1):74-85.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:							
Taxa, Species, Age:	,	Fish; Oncorhynchus kisutch; Embryo	1				
Health Outcome:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology						
Chemical:	• ·	erpentine) (CASRN 12001-29-5)					
HERO ID:	3584231						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	Medium	It was unclear if outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	. / Variable Co	ntrol					
Domain 0. Comountuing	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
	Weute 17.	Design and Procedures	Low	conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Low	There were no differences among groups but, few details were provided.			
		r					
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	N/A	The study focused on pathology findings.			
	Metric 22:	Reporting of Data	Low	Data were only reported for some outcomes.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.			
Additional Comments:	None						
Overall Qualit	ty Deterr	nination	Low				

Study Citation:	•	E., Schurr, K., Allen, D. J., Gohara, A. F. (1 stress. Environmental Research 39(1):74-8		chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and			
Duration:		ation: > 21 days; Exposure Duration: > 21					
Exposure Route,			•	nical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:	riquine (ire	sinder), water, rot determined by study a	utilois (i.e., eilei				
Taxa, Species, Age:	Vertebrate:	Fish; Oncorhynchus kisutch; Juvenile					
Health Outcome:	Mortality						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3584231						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing laboratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.			
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The control group had a high mortality of 13%.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Ch	aracterization						
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.			
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.			
	Metric 10:	Concentration Exposure Duration and Frequency	Low	A long duration study was performed (86 days).			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one test concentration was tested.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organis	m						
Bomani 4. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source			
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			

Low

Low

High

Continued on next page ...

Replicates were not reported.

Mortalities were checked twice a day.

quate.

Environmental conditions were not sufficiently reported to evaluate if they were ade-

Conditions Number of Organisms and

Adequacy of Test Conditions

Outcome Assessment Methodology

Replicates per Group

Metric 15:

Metric 16:

Metric 17:

Domain 5: Outcome Assessment

Study Citation:	Belanger, S.	E., Schurr, K., Allen, D. J., Gohara, A. F. (19	986). Effects of	chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and				
		stress. Environmental Research 39(1):74-85						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path:								
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Juvenile							
Health Outcome:	Mortality							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)						
HERO ID:	3584231							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	g / Variable Co	ntrol						
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.				
Domain 7: Data Present	ation and Anal	vsis						
Domain 7. Dua Present	Metric 21:	Statistical Methods	Low	Statistical analysis was not reported, but raw data was available.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.				
	None							
Additional Comments:								

Study Citation:	Belanger, S. E., Schurr, K., Allen, D. J., Gohara, A. F. (1986). Effects of chrysotile asbestos on coho salmon and green sunfish: evidence of behavioral and pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	
Taxa, Species, Age:	Vertebrate; Fish; Oncorhynchus kisutch; Juvenile
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	Low	It was unclear if the test substance identity analytically verified by the performing labo- ratory. See Stewart and Schurr (1980) for confirmation, otherwise this assessment was based on information provided in the text.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
8	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The control group had a high mortality of 13%. The behavioral response was not clearly described.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
2 chian of Exposure of	Metric 7:	Experimental System/Test Media	Medium	The study provided only limited details on the measures taken to appropriately prepare
		Preparation		test concentrations (used sonification).
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Administration Measurement of Test Substance	Low	Measurements were not reported.
	Metric 10:	Concentration Exposure Duration and Frequency	Low	Study authors reported a long duration (40 days).
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.
		Spacing of Exposure Levels		•
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
Domain in Test organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Conditions Number of Organisms and	Low	Replicates were not reported.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported.
			Continued on next page	

		e	continued from previous pa	age
Study Citation:	Belanger, S.	E., Schurr, K., Allen, D. J., Gohara, A. F. (1	986). Effects of chrysotile a	sbestos on coho salmon and green sunfish: evidence of behavioral and
		stress. Environmental Research 39(1):74-8		
Duration:		ation: > 21 days; Exposure Duration: > 21		
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e., chemical of inte	rest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:		Fish; Oncorhynchus kisutch; Juvenile		
Health Outcome:	Behavioral			
Chemical:	-	erpentine) (CASRN 12001-29-5)		
HERO ID:	3584231			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	Medium	Outcomes were assessed consistently across study groups, but few details were pro-
		Assessment		vided.
Domain 6: Confounding	-			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmenta
		Design and Procedures		conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups, but few details were provided.
Domain 7: Data Present	tation and Anal	Veia		
Domain 7. Data Present	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.
	Metric 22:	Reporting of Data	Low	The results were not completely reported.
	Metric 22:	Explanation of Unexpected Outcomes	Medium	No unexpected outcomes were reported.
	Wieute 25.	Explanation of Onexpected Outcomes	Wiedrum	No unexpected outcomes were reported.
Additional Comments:	None			

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Study Citation:			ctional and patho	logical impairment of japanese medaka (Oryzias latipes) by long-term asbestos
Destination		quatic Toxicology 17(2):133-154.	21.1	
Duration:		ation: 11 - 21 days; Exposure Duration: 11 -		
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study a	uthors (i.e., chen	nical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:		Fish; Oryzias latipes; Embryo		
Health Outcome:	Developmer			
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory, as seen on p 139.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
-	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cha	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisr				
Domain 4. 16st Organish	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	Metric 13. Metric 14:	Acclimatization and Pretreatment	Medium	
		Conditions		All pretreatment conditions were the same for control and exposed organisms, though they were not explicitly stated.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were only 10 organisms with no replicates reported.
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
		Conti	nued on next pa	ge
			Daga 25 of 419	5

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			inaca iroin previo	ne hale
Study Citation:		E., Cherry, D. S., Cairns, J. (1990). Furquatic Toxicology 17(2):133-154.	nctional and pathol	ogical impairment of japanese medaka (Oryzias latipes) by long-term asbesto
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 11	- 21 days	
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study	authors (i.e., chemi	cal of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:	Vertebrate; F	Fish; Oryzias latipes; Embryo		
Health Outcome:	Developmen	t/Growth		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.
		Assessment		
Domain 6: Confounding	Variable Co	atral		
Domain 6: Confounding	Metric 19:	Confounding Variables in Test	Low	The study did not mayide anough information to allow a comparison of anyier montal
	Methe 19.	Design and Procedures	LOW	The study did not provide enough information to allow a comparison of environmental conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present	ation and Anal	voie		
Domain 7. Data Present	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group
	Metric 22: Metric 23:		High	Unexpected outcomes were satisfactorily explained.
	Weute 25:	Explanation of Unexpected Outcomes	nigii	Onexpected outcomes were satisfactority explained.
Additional Comments:	This portion	of the study was conducted in aquaria.		
	ty Data	ningtion	Madiu	
Overall Qualit	ly Delern	iiiiatiofi	Medium	

Study Citation:	•	· · · · · · · · · · · · · · · · · · ·	ctional and patho	ological impairment of japanese medaka (Oryzias latipes) by long-term asbestos
Duration:		quatic Toxicology 17(2):133-154. ation: 11 - 21 days; Exposure Duration: 11	- 21 days	
Exposure Route,				nical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	i iquaite (ire			
Taxa, Species, Age:	Vertebrate: I	Fish; Oryzias latipes; Embryo		
Health Outcome:	Developmen			
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	nce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory, as seen on p.139.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
e	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	naracterization			
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Orceria	192			
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	Metric 13. Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms, though
	Mente 14.	Conditions	wiculuili	they were not explicitly stated.
	Metric 15:	Number of Organisms and	Low	There were only 10 organisms with no replicates used.
		Replicates per Group	2011	
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	inued on next pa	00P

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			•	
Study Citation:			tional and pathol	ogical impairment of japanese medaka (Oryzias latipes) by long-term asbesto
D (1		quatic Toxicology 17(2):133-154.	01.1	
Duration:		ation: 11 - 21 days; Exposure Duration: 11 -		
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e., chemi	cal of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:		Fish; Oryzias latipes; Embryo		
Health Outcome:	Developmen	t/Growth		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.
		Assessment		
Domain 6: Confounding	v / Variable Co	ntrol		
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
	metric 17.	Design and Procedures	Low	conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
			mean	There was no information in the study to suggest differences allong groups.
Domain 7: Data Present	ation and Anal	ysis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	This portion	of the study was conducted in petri dishes.		
Additional Comments:	This portion	of the study was conducted in petri dishes.		
	ty Detern		Medium	

Study Citation:	U ,	· · · · · · · · · · · · · · · · · · ·	ctional and patho	logical impairment of japanese medaka (Oryzias latipes) by long-term asbestos
		quatic Toxicology 17(2):133-154.	21.1	
Duration:		ation: 11 - 21 days; Exposure Duration: 11		
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (1.e., chen	nical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:		Fish; Oryzias latipes; Embryo		
Health Outcome:	Mortality			
Chemical:	•	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory, as seen on p 179.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Ĩ	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.
		Spacing of Exposure Levels	-	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms though
	Metric 15:	Conditions Number of Organisms and	Low	this was not explicitly stated.
	Methe 15.	Replicates per Group	LOW	There were10 organisms per treatment group.
Domain 5: Outcome As	recement			
Domain 5. Outcome As		A deguage of Test Conditions	Low	Environmental conditions were not sufficiently reported to evolute if they were al-
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.

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Study Citation:	Belanger, S.	. E., Cherry, D. S., Cairns, J. (1990). Fund	ctional and pathol	ogical impairment of japanese medaka (Oryzias latipes) by long-term asbestos
·	exposure. A	quatic Toxicology 17(2):133-154.		
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 11 -	- 21 days	
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study a	uthors (i.e., chemi	ical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:	Vertebrate; H	Fish; Oryzias latipes; Embryo		
Health Outcome:	Mortality			
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046	-		
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.
		Assessment		
Domain 6: Confounding	y / Variable Co	ntrol		
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
	Mettre 19.	Design and Procedures	Low	conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present		lysis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	This portion	of the study was conducted in petri dishes.		
Overall Qualit	tv Deterr	nination	Medium	

Study Citation:	0	E., Cherry, D. S., Cairns, J. (1990). Fund quatic Toxicology 17(2):133-154.	ctional and patho	ological impairment of japanese medaka (Oryzias latipes) by long-term asbestos
Duration:		ation: 11 - 21 days; Exposure Duration: 11	- 21 davs	
Exposure Route,				nical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:	Vertebrate: I	Fish; Oryzias latipes; Embryo		
Health Outcome:	Mortality	······		
Chemical:	5	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory, as seen on p 139.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	The study provided limited details on the measures taken to appropriately prepare test
	Metric 7.	Preparation	Medium	concentrations.
	Metric 8:	Consistency of Exposure	Medium	Some details of exposure administration were reported; exposures were administered
		Administration	11100101111	consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.
		Spacing of Exposure Levels	U	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
č	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms, though
		Conditions		they were not explicitly stated.
	Metric 15:	Number of Organisms and	Low	There were only 10 organisms with no replicates reported.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	inued on next pa	Δ

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Study Citation:	-	-	ctional and pathol	ogical impairment of japanese medaka (Oryzias latipes) by long-term asbesto
D		quatic Toxicology 17(2):133-154.	21 Jan	
Duration:		ation: 11 - 21 days; Exposure Duration: 11		
Exposure Route, Media, Path:	Aquatic (free	shwater); water; Not determined by study a	utnors (i.e., chemi	ical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate: H	Fish; Oryzias latipes; Embryo		
Health Outcome:	Mortality	, , , , , , , , , , , , , , , , , , ,		
Chemical:	2	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.
		Assessment		
Domain 6: Confounding	, / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	conditions.
	Metric 20:	Outcomes Onrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	This portion	of the study was conducted in aquaria.		
		· · ·		
Overall Qualit	ty Detern	nination	Medium	

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Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	ation: > 21 days; Exposure Duration: > 2	1 days	ected aquatic organisms to chrysotile asbestos. chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mechanistic	Fish; <i>Oryzias latipes</i> ; Larvae -Liver toxicology erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substar	nce			
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cl	haracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose
		Spacing of Exposure Levels		response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	sm			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The F0 generation was acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	The number of replicates was unclear; 15 organisms per treatment were used.
Domain 5: Outcome As	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Con	tinued on nex	xt page
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Study Citation:	Belanger, S.	E. (1985). Functional and pathological res	ponses of sel	ected aquatic organisms to chrysotile asbestos.
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	authors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route
Media, Path:				
Taxa, Species, Age:	Vertebrate; F	Fish; Oryzias latipes; Larvae		
Health Outcome:	Mechanistic-	-Liver toxicology		
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)		
HERO ID:	4350438			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment		
		Assessment		
Domain 6: Confounding	g / Variable Cor			
Domain 6: Confounding	g / Variable Cor Metric 19:		High	There were no reported differences among the study groups in environmental conditions.
Domain 6: Confounding	-	ntrol	High	There were no reported differences among the study groups in environmental conditions.
Domain 6: Confounding	-	ntrol Confounding Variables in Test	High High	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.
	Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure		
	Metric 19: Metric 20: tation and Anal	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	High	There were no differences among groups.
Domain 6: Confounding	Metric 19: Metric 20: tation and Anal Metric 21:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	High	There were no differences among groups. Statistical methods were adequately described.
	Metric 19: Metric 20: tation and Anal Metric 21: Metric 22:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods Reporting of Data	High High High	There were no differences among groups. Statistical methods were adequately described. Data for exposure-related findings were presented for each treatment and control group.
	Metric 19: Metric 20: tation and Anal Metric 21:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	High	There were no differences among groups. Statistical methods were adequately described.
	Metric 19: Metric 20: tation and Anal Metric 21: Metric 22:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods Reporting of Data	High High High	There were no differences among groups. Statistical methods were adequately described. Data for exposure-related findings were presented for each treatment and control group.

Asbestos

Study Citation:	Belanger, S.	E. (1985). Functional and pathological re-	sponses of sel	ected aquatic organisms to chrysotile asbestos.			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Exposure Route,							
Media, Path:							
Taxa, Species, Age:	: Vertebrate; Fish; Oryzias latipes; Larvae						
Health Outcome:	Mechanistic	-Kidney/renal					
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
Domain 1: Test Substar	ice						
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.			
Domain 2: Test Design							
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
	intente or		2011				
Domain 3: Exposure Cl							
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.			
	Metric 9:	Administration Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.			
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.			
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose			
		Spacing of Exposure Levels	U	response the by study author.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organis	m						
Domain 1. 1050 Organie	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.			
	Metric 14:	Acclimatization and Pretreatment	High	The FO generation was acclimatized to lab conditions.			
	mente i n	Conditions	111511	The respectation was accommanded to no conditions.			
	Metric 15:	Number of Organisms and	Low	The number of replicates were unclear; 15 organisms per treatment were used.			
		Replicates per Group					
Domain 5: Outcome As	sessment						
Domain J. Outcome As	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of test system were conducive to maintenance of organism			
	wienie 10:	Adequacy of rest Conditions	High	Environmental conditions of test system were conducive to maintenance of organism health.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
		Assessment					

continued from previous page							
Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:							
Taxa, Species, Age:	Vertebrate; Fish; Oryzias latipes; Larvae						
Health Outcome:	Mechanistic-Kidney/renal						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Con Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High High	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	No unexpected outcomes were reported.			
Additional Comments:	None						
Overall Quality Determination			High				

Study Citation:	-		-	ected aquatic organisms to chrysotile asbestos.
Duration:		ation: > 21 days; Exposure Duration: > 2	•	
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study	authors (1.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	T 7 , 1 , T			
Taxa, Species, Age:		Fish; Oryzias latipes; Larvae		
Health Outcome:		-Gastrointestinal		
Chemical:	•	erpentine) (CASRN 12001-29-5)		
HERO ID:	4350438			
Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
D				
Domain 2: Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 4.	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable.
	Metric 5:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
	Weute 0.	Kandonnized / mocarion	Low	Researchers did not report now organisms were anocated to study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose
		Spacing of Exposure Levels	8	response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4. Toot Orre				
Domain 4: Test Organis	m Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
	Metric 13: Metric 14:	Test Organism Characteristics Acclimatization and Pretreatment	High High	The test organisms were adequately described and were obtained from a reliable source.
	Meule 14:	Conditions	High	The F0 generation was acclimatized to lab conditions.
	Metric 15:	Number of Organisms and	Low	The number of replicates were unclear; 15 organisms per treatment were used.
		Replicates per Group		
Domain 5: Outcome As				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.

		conti	nued from p	previous page			
Study Citation:	Belanger, S.	E. (1985). Functional and pathological res	ponses of sel	lected aquatic organisms to chrysotile asbestos.			
Duration:	Overall Dura	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Aquatic (free	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:							
Taxa, Species, Age:	Vertebrate; F	Fish; Oryzias latipes; Larvae					
Health Outcome:	Mechanistic-	Mechanistic-Gastrointestinal					
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)					
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were no unexpected outcomes.			
Additional Comments:	This portion	of the study was performed on intestinal g	oblet cells.				
Overall Qualit	y Detern	nination	High				

Study Citation:			nctional and p	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbesto				
		quatic Toxicology 17(2):133-154.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Vertebrate; Fish; <i>Oryzias latipes</i> ; Larvae ADME (biotransformation)							
Media, Path:								
Taxa, Species, Age:								
Health Outcome:	(
Chemical:	•	erpentine) (CASRN 12001-29-5)						
HERO ID:	3585046							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar		— • • • • •	-					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.				
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Cl								
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.				
	Metric 8:	Consistency of Exposure	Medium	Some details of exposure administration were reported; exposures were administered				
		Administration		consistently across study groups.				
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were measured, but the methods used were not clear.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.				
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.				
		Spacing of Exposure Levels						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
Domain 4: Test Organis	sm							
C C	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	All pretreatment conditions were the same for control and exposed organisms, though this was not explicitly stated.				
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 15 organisms with three replicates used.				
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
		~	tinued on nex					

		contir	nued from p	previous page
Study Citation:	Belanger, S.	E., Cherry, D. S., Cairns, J. (1990). Fund	ctional and	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos
		quatic Toxicology 17(2):133-154.		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:	Vertebrate; I	Fish; Oryzias latipes; Larvae		
Health Outcome:	ADME (biot	transformation)		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046	• · · · ·		
Domain		Metric	Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.
		Assessment		
Domain 6: Confounding	g / Variable Co	ntrol		
c c	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.
		Design and Procedures	0	
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.
Domain 7: Data Present	ation and Anal	lyreig		
Domain 7. Data Meselli	Metric 21:	Statistical Methods	N/A	This part of the study focused on pathology findings. Body burden was reported but not
	Wieute 21.	Statistical Methous	IN/A	analyzed.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	None			
Overall Qualit	ty Deterr	nination	High	

Study Citation:			nctional and p	bathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos					
Duration:		quatic Toxicology $17(2)$:133-154. ation: > 21 days; Exposure Duration: > 2	1 days						
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	i iquaite (ii e	quare (neshwater), water, not determined by study autions (ne., chemical or interest in exposure water, but anable to determine exact uptake route)							
Taxa, Species, Age:	Vertebrate: F	Fish; Oryzias latipes; Larvae							
Health Outcome:	Mortality								
Chemical:	2	erpentine) (CASRN 12001-29-5)							
HERO ID:	3585046								
Domain		Metric	Rating	Comments					
Domain 1: Test Substanc	e								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.					
Domain 2: Test Design									
e	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported and was suitable.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
	, . , .								
Domain 3: Exposure Cha									
	Metric 7:	Experimental System/Test Media	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.					
	Metric 8:	Preparation Consistency of Exposure	Medium	Some details of exposure administration were reported; exposures were administered					
	Wieute 8.	Administration	Medium	consistently across study groups.					
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were measured, but the methods used were not clear.					
	Medile 9.	Concentration	meanum	Exposure concentrations were incusared, out the methods used were not creat.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.					
		Spacing of Exposure Levels							
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organisn	1								
5	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	All pretreatment conditions were the same for control and exposed organisms, though this was not explicitly stated.					
	Metric 15:	Number of Organisms and	Medium	There were 15 organisms with three replicates used.					
		Replicates per Group							
Domain 5: Outcome Asso	essment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.					
		Assessment							

Study Citation:	Belanger, S.	E., Cherry, D. S., Cairns, J. (1990). Fund	ctional and	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbesto
		quatic Toxicology 17(2):133-154.		
Duration:		ation: > 21 days; Exposure Duration: > 21		
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age:	Vertebrate; F	Fish; Oryzias latipes; Larvae		
Health Outcome:	Mortality			
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 6: Confounding				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.
		Design and Procedures	TT' 1	T
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.
Domain 7: Data Present	ation and Anal	ysis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	None			
Overall Qualit	t v Deter r	nination	High	

Study Citation:			nctional and p	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos
Duration:	1	quatic Toxicology 17(2):133-154. ation: > 21 days; Exposure Duration: > 2	1 days	
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	1	· · · · · · · · · · · · · · · · · · ·		
Taxa, Species, Age:	Vertebrate; I	Fish; Oryzias latipes; Juvenile		
Health Outcome:	Developmen	t/Growth		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substan			_	
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported. Survival was re- ported to be somewhat low.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cl	naracterization			
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of the exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	Medium	Only two exposure groups were used.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	sm			
e	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms, though
		Conditions		this was not explicitly stated.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 15 organisms with four replicates used in breeding tanks.
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Con	tinued on nex	/t nogo

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Study Citation:		Belanger, S. E., Cherry, D. S., Cairns, J. (1990). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.					
Duration:			J				
		ation: > 21 days; Exposure Duration: > 21					
Exposure Route, Media, Path:	Aquatic (fres	snwater); water; Not determined by study a	utnors (1.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)			
Taxa, Species, Age:	Vartabrata: E	ish; Oryzias latipes; Juvenile					
Health Outcome:	Developmen	, , , ,					
Chemical:	•						
HERO ID:	•	erpentine) (CASRN 12001-29-5)					
HERU ID:	3585046						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.			
		Assessment					
Domain & Confoundin	a / Variabla Car	atual					
Domain 6: Confounding	Metric 19:		Iliah				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups			
	Mettic 20.	Outcomes Offenated to Exposure	nigii	There were no differences among groups.			
Domain 7: Data Presen	tation and Anal	veic					
Domain 7. Data Presen	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
		Explanation of Chexpected Sutcomes	man	chexpected outcomes were substactorily explained.			
Additional Comments:	This portion	of the study evaluated F1 effects.					

Study Citation:	•	· · · · · · · · · · · · · · · · · · ·	nctional and j	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos					
Duration:		quatic Toxicology 17(2):133-154. ation: > 21 days; Exposure Duration: > 2	1 days						
Exposure Route,		Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path:	riquitie (fre								
Faxa, Species, Age:	Vertebrate; I	Fish; Oryzias latipes; Juvenile							
Health Outcome:	Mortality	, i joint _r							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)							
HERO ID:	3585046	-							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported. Survival was re- ported to be somewhat low.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	naracterization								
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.					
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.					
	Metric 9:	Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured or reported.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/	Medium	Only two exposure groups were used.					
		Spacing of Exposure Levels							
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	sm								
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms, though					
		Conditions		this was not explicitly stated.					
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 15 organisms with four replicates used in breeding tanks.					
		Tophoulos por Group							
Domain 5: Outcome As	ssessment								
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	tinued on nex						

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Study Citation:	Belanger, S.	E., Cherry, D. S., Cairns, J. (1990). Fund	ctional and	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos			
Demotions		quatic Toxicology 17(2):133-154.	4				
Duration:		ation: > 21 days; Exposure Duration: > 21					
Exposure Route, Media, Path:	Aquatic (free	snwater); water; Not determined by study a	utnors (1.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)			
· ·	Vartabrata, I	Tich Omerica latin an Invenile					
Taxa, Species, Age:		Fish; Oryzias latipes; Juvenile					
Health Outcome:	Mortality	,					
Chemical:	•	erpentine) (CASRN 12001-29-5)					
HERO ID:	3585046						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.			
		Assessment					
Domain & Confounding	Variable Co	ntuol					
Domain 6: Confounding	Metric 19:		High				
	Metric 19.	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups.			
	Wietrie 20.	Outcomes Officiated to Exposure	Ingn	There were no unreferees among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
		L L	0				
Additional Comments:	None						
Overall Qualit	t <mark>v Deter</mark> n	nination	High				
Quan Quan	j Detern		111611				

Study Citation:	-	-	nctional and J	pathological impairment of japanese medaka (Oryzias latipes) by long-term asbesto
Duration:	1	quatic Toxicology 17(2):133-154. ation: > 21 days; Exposure Duration: > 2	21 davs	
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:		• •		•
Taxa, Species, Age:	Vertebrate; I	Fish; Oryzias latipes; Juvenile		
Health Outcome:	•	e/Teratogenic		
Chemical:	•	erpentine) (CASRN 12001-29-5)		
HERO ID:	3585046			
Domain		Metric	Rating	Comments
Domain 1: Test Substan			_	
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier and prepared by milling the fibers through a Fisher Ultrasonic Cleaner.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control groups was reported. Survival was re- ported to be somewhat low.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Some details of exposure administration were reported; exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured or reported.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	Medium	Only two exposure groups were used.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Medium	All pretreatment conditions were the same for control and exposed organisms, though
		Conditions		this was not explicitly stated.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 15 organisms with four replicates used in breeding tanks.
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Com	tinued on nex	zt nogo

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Study Citation:			Belanger, S. E., Cherry, D. S., Cairns, J. (1990). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos					
Destin		quatic Toxicology 17(2):133-154.	1					
Duration:		ation: > 21 days; Exposure Duration: > 21						
Exposure Route,	Aquatic (free	shwater); water; Not determined by study a	utnors (1.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)				
Media, Path:	Vantalander F	Take Ormaina Intin on Israelle						
Taxa, Species, Age:		Fish; Oryzias latipes; Juvenile						
Health Outcome:		e/Teratogenic						
Chemical:	•	erpentine) (CASRN 12001-29-5)						
HERO ID:	3585046							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome	High	Mortalities were checked daily.				
		Assessment						
Domain 6: Confounding	y / Variable Cou	ntrol						
Domain o. Comounaing	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.				
		Design and Procedures	ing.					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.				
		· · · · · · · · · · · · · · · · · · ·	8					
Domain 7: Data Present	ation and Anal	ysis						
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.				
Additional Comments:	This portion	of the study evaluated F1 effects.						
0ll 0ll			TT! _ l.					
Overall Qualit	ty Detern	nination	High					

Asbestos

udy Citation: Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.							
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Vertebrate; Fish; <i>Pimephales promelas</i> ; Juvenile ADME (biotransformation)						
Media, Path:							
Taxa, Species, Age:							
Health Outcome:							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan	ice						
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performin laboratory.			
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.			
Domain 2: Test Design							
2. 1000 Doolgii	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported, other than a mention that there were no acute effects.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Ch	onostanization						
Domain 5. Exposure Cr	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described			
		Preparation	8	in adequate detail.			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.			
		Administration	-				
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dos response by study author.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domoin 4. Tost Organia							
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source			
	Metric 13: Metric 14:	Acclimatization and Pretreatment	U				
	Meuric 14:	Conditions	Low	It was not reported if the organisms were acclimatized to lab conditions.			
	Metric 15:	Number of Organisms and	Low	There were two replicates and 10 organisms per replicate.			
		Replicates per Group					
Domain 5: Outcome As	sessment						
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
			nued on next pa				

Study Citation:	Balangar S	E (1085) Eurotional and pathological reas	nonses of selected	aquatic organisms to chrysofile aspectos				
Duration:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)							
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path:	Aquatic (restiwater), water, not determined by study autions (i.e., chemical of interest in exposure water, but unable to determine exact uptake foute)							
Taxa, Species, Age:	Vertebrate; Fish; Pimephales promelas; Juvenile							
Health Outcome:		ransformation)						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)						
HERO ID:	4350438							
Domain		Metric	Rating	Comments				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	, / Variable Co	atrol						
Domain of Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.				
		Design and Procedures	U					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.				
Domain 7: Data Present	ation and Anal	ysis						
	Metric 21:	Statistical Methods	Low	Statistical analyses are not typically used for ADME studies.				
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were not presented for each treatment and control group.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	No accumulation was reported.				
Additional Comments:	This portion	of the study evaluated accumulation.						
Overall Qualit	v Dotorr	nination	Medium					

	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.						
	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h) Aquatic (freehwater): Water: Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact untake route)						
Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
ia, Path: , Species, Age: Vertebrate; Fish; <i>Pimephales promelas</i> ; Juvenile							
2	erpentine) (CASRN 12001-29-5)						
4350438							
	Metric	Rating	Comments				
ce							
Metric 1:	Test Substance Identity	Medium	The test substance was identified and the specific form was characterized				
Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.				
Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.				
Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported, other than men- tion that there was no acute effects.				
Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
aractorization							
	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described				
Wetter 7.		Ingn	in adequate detail.				
Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
	Administration						
Metric 9:		Medium	Exposure concentrations were not measured, but stock preps were analyzed.				
Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type.				
Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose				
	Spacing of Exposure Levels	2	response by study author.				
Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
m							
Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the organisms were acclimatized to lab conditions.				
Matria 15	Conditions	Low					
wieuric 15:	6	LOW	There were two replicates and 10 organisms per replicate.				
	Replicates per Gloup						
sessment							
Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
1	Aquatic (free Vertebrate; 1 Mortality chrysotile (s 4350438 Cee Metric 1: Metric 2: Metric 2: Metric 3: Metric 3: Metric 5: Metric 5: Metric 6: Metric 6: Metric 7: Metric 8: Metric 8: Metric 9: Metric 10: Metric 11: Metric 12: m Metric 13: Metric 12: Metric 13: Metric 12: Metric 11: Metric 10: Metric 11: Metric 11: Metric 12: Metric 12: Metric 12: Metric 12: Metric 13: Metric 14: Metric 14: Metric 14: Metric 14: Metric 14: Metric 15: Metric 12: Metric 12: Metric 12: Metric 12: Metric 12: Metric 12: Metric 13: Metric 14: Metric 15:	Aquatic (freshwater); Water; Not determined by study a Vertebrate; Fish; Pimephales promelas; Juvenile Mortality chrysotile (serpentine) (CASRN 12001-29-5) 4350438 Metric ce Metric 1: Test Substance Identity Metric 2: Test Substance Source Metric 3: Test Substance Purity Metric 6: Randomized Allocation Metric 7: Experimental System/Test Media Preparation Metric 8: Consistency of Exposure Administration Metric 10: Exposure Duration and Frequency Metric 11: Number of Exposure Groups/ Spacing of Exposure Levels Metric 12: Test Organism Characteristics Metric 13: Test Organism Characteristics Metric 14: Acclimatization and Pretreatment Conditions Replicates per Group	Aquatic (freshwater); Water; Not determined by study authors (i.e., cher Vertebrate; Fish; Pimephales promelas; Juvenile Mortality chrysotile (serpentine) (CASRN 12001-29-5) 4350438				

		contin	nued from previo	us page			
Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.						
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)						
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e., chemi	cal of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Vertebrate; F	Fish; Pimephales promelas; Juvenile					
Health Outcome:	Mortality						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	g / Variable Con	ntrol					
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
		Design and Procedures					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Low	The statistical analysis consisted of mean +/- SE.			
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not presented for each treatment and control group. The results were only reported as no acute effects, page 134.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.			
Additional Comments:	This portion	of the study evaluated mortality.					
Overall Qualit	ty Determ	nination	Medium				

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Study Citation: Duration: Exposure Route,	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h) Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path:	Vertebrate; Fish; <i>Pimephales promelas</i> ; Adult							
Taxa, Species, Age:								
Health Outcome:	· · · · · · · · · · · · · · · · · · ·	transformation)						
Chemical:	-	erpentine) (CASRN 12001-29-5)						
HERO ID:	4350438							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce							
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.				
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.				
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.				
Domain 2: Test Design								
2 smain 2. Tost Dosigli	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported, other than a mention that there were no acute effects.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch		Europimontal System /Test Madia	High					
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.				
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
	Weate 0.	Administration	Ingn	Exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.				
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose				
		Spacing of Exposure Levels		response by the study author.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
Domain 4: Test Organis	m							
U	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the organisms were acclimatized to lab conditions.				
	M-4., 15	Conditions	т					
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates and 10 organisms per replicate.				
		Replicates per Gloup						
Domain 5: Outcome Ass	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				

This was an	accumulation study.						
Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were not satisfactorily explained.				
Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were not presented for each treatment and control group.				
		Low	Statistical analysis are not typically used for ADME studies.				
	5						
Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups.				
Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.				
y / Variable Co	atrol						
metrie 10.	Assessment	mgn	Outcomes were assessed consistently deross study groups.				
Metric 18:		0	Comments Outcomes were assessed consistently across study groups.				
		D. (*					
4350438							
· · · · · · · · · · · · · · · · · · ·	,						
Vertebrate: Fish: Pimenhales prometers: Adult							
Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.							
	Overall Dura Aquatic (fres Vertebrate; F ADME (biot chrysotile (se 4350438 Metric 18: g / Variable Con Metric 19: Metric 20: ation and Anal Metric 21: Metric 22: Metric 23:	Belanger, S. E. (1985). Functional and pathological resp Overall Duration: 0 - 4 days (0-96h); Exposure Duration Aquatic (freshwater); Water; Not determined by study a Vertebrate; Fish; <i>Pimephales promelas</i> ; Adult ADME (biotransformation) chrysotile (serpentine) (CASRN 12001-29-5) 4350438 <u>Metric</u> Metric 18: Consistency of Outcome Assessment g / Variable Control Metric 19: Confounding Variables in Test Design and Procedures Metric 20: Outcomes Unrelated to Exposure ation and Analysis Metric 21: Statistical Methods Metric 22: Reporting of Data	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96 Aquatic (freshwater); Water; Not determined by study authors (i.e., chemi Vertebrate; Fish; Pimephales promelas; Adult ADME (biotransformation) chrysotile (serpentine) (CASRN 12001-29-5) 4350438 Metric Rating Metric 18: Consistency of Outcome High Assessment g / Variable Control Metric 19: Confounding Variables in Test Design and Procedures Metric 20: Outcomes Unrelated to Exposure Metric 21: Statistical Methods Low Metric 22: Metric 23: Explanation of Unexpected Outcomes				

Study Citation:		anger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.						
Duration: Exposure Route,		Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h) Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Vertebrate; Fish; <i>Pimephales promelas</i> ; Adult						
Media, Path:	r quarie (IIe							
Taxa, Species, Age:	Vertebrate; l							
Health Outcome:	Mortality							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)						
HERO ID:	4350438							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar								
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.				
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.				
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.				
Domain 2: Test Design								
2 cilialii 2. 1050 2051gii	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported, other than a mention that there were no acute effects.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Cl								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.				
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose				
		Spacing of Exposure Levels	6	response by the study author.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
Domain 4: Test Organis	sm							
0	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the organisms were acclimatized to lab conditions.				
	Metric 15:	Conditions Number of Organisms and	Low	There were two replicates and 10 organisms per replicate.				
		Replicates per Group						
Domain 5: Outcome As	ssessment							
Domain 5. Outcome Ac	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
		0.	nued on next pa	07 I				

		contin	nued from previo	us page				
Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.							
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)							
Exposure Route,	Aquatic (free	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:								
Taxa, Species, Age:	Vertebrate; F	Fish; Pimephales promelas; Adult						
Health Outcome:	Mortality							
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)						
HERO ID:	4350438							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	g / Variable Cor	ntrol						
-	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.				
		Design and Procedures						
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.				
Domain 7: Data Present	ation and Anal	veie						
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	The statistical analysis was reported as +/- SE.				
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not presented for each treatment and control group. The results were only reported as no acute effects, page 134.				
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.				
Additional Comments:	This portion	of the study evaluated mortality.						
Overall Qualit	ty Determ	nination	Medium					

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Asbestos

Study Citation: Duration: Exposure Route, Media, Path:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (bio	Fish; <i>Pimephales promelas</i> ; Juvenile transformation) erpentine) (CASRN 12001-29-5)				
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Medium High	The test substance was identified, and the specific form was characterized. The test substance identity was analytically characterized and verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.		
Domain 2: Tast Dasian						
Domain 2: Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported, and high control mortality was noted.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Ch	aracterization Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Preparation Consistency of Exposure	High	Exposures were administered consistently across study groups.		
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.		
Domain 4: Test Organis	m					
2 chain in 10st Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were two replicates with 10 organisms per replicate.		
Domain 5: Outcome Ass	sessment Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.		
		Conf	tinued on nex	t page		
			Dage 57 of			

			nucu nom p					
Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.							
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path:								
Taxa, Species, Age:	Vertebrate; Fish; Pimephales promelas; Juvenile							
Health Outcome:		ransformation)						
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)						
HERO ID:	4350438							
Domain		Metric	Rating	Comments				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	v / Variable Co	atrol						
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.				
	Methe 17.	Design and Procedures	mgn	There were no reported unreferees among the study groups in environmental conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.				
		1	0					
Domain 7: Data Present	ation and Anal	ysis						
	Metric 21:	Statistical Methods	N/A	Statistical analysis is typically not conducted for ADME studies.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with no unexpected outcomes.				
Additional Comments:	None							
Overall Qualit	ty Detern	nination	High					

Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: > 21 days; Exposure Duration: > 21 days								
Duration: Exposure Route,			•	chamical of interact in avnosura water, but unable to datermine avact untake route)					
Media, Path:	Aquatic (fre	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Vertebrate; Fish; <i>Pimephales promelas</i> ; Adult Behavioral							
Taxa, Species, Age:	Vertebrate:]								
Health Outcome:	Behavioral								
Chemical:	chrysotile (s	serpentine) (CASRN 12001-29-5)							
HERO ID:	4350438								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	ice								
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported, and high control					
				mortality was noted.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 2. Exposure Ch	onostanization								
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described					
	Wiettie 7.	Preparation	Ingn	in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
		Administration	-						
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate					
				for the study type.					
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose					
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	response by the study author. Asbestos is considered insoluble.					
	Wieule 12.	resting at or below Solubility Ellilit	11/71						
Domain 4: Test Organis									
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.					
	Metric 15:	Conditions Number of Organisms and	Low	There were two replicates with 10 organisms per replicate.					
		Replicates per Group		1 0 1 1					
Domain 5: Outcome As	leasement								
Domain 5: Outcome As	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system wars conducive to the maintaneness of an					
	mente 10:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
			tinued on nex						

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		contin	nued from p	revious page		
Study Citation:				ected aquatic organisms to chrysotile asbestos.		
Duration:		ation: > 21 days; Exposure Duration: > 21				
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Vertebrate; I	Fish; Pimephales promelas; Adult				
Health Outcome:	Behavioral					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	4350438					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding						
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data i resent	Metric 21:	Statistical Methods	High	Statistical analysis was conducted.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected.		
Additional Comments:	This portion	of the study evaluated swimming performa	ince.			
Overall Qualit	ty Deterr	nination	High			

Study Citation:										
Duration: Exposure Route,		ation: > 21 days; Exposure Duration: > 2 shwater): Water: Not determined by study	-	chemical of interest in exposure water, but unable to determine exact uptake route						
Media, Path:	Aquatic (ife	sitwater), water, Not determined by study	autions (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route,						
Taxa, Species, Age:	Vertebrate: I	Fish; Pimephales promelas; Adult								
Health Outcome:	Developmen									
Chemical:		chrysotile (serpentine) (CASRN 12001-29-5)								
HERO ID:	4350438									
Domain		Metric	Rating	Comments						
Domain 1: Test Substan										
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.						
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.						
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.						
Domain 2: Test Design										
_ , 1050 _ 051gh	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.						
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported.						
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.						
Domain 2. Exposure Ch	anastanization									
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described						
	Weute 7.	Preparation	mgn	in adequate detail.						
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.						
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.						
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.						
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose						
		Spacing of Exposure Levels	8	response by the study author.						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.						
Domain 4: Test Organis	m									
Domain 1. 10st Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.						
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.						
		Conditions	U							
	Metric 15:	Number of Organisms and	Low	There were two replicates with 10 organisms per replicate.						
		Replicates per Group								
Domain 5: Outcome As	sessment									
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.						
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.						
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.						
		Assessment								

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continued from previous page						
Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)				
Taxa, Species, Age:	Vertebrate; F	Vertebrate; Fish; Pimephales promelas; Adult				
Health Outcome:	Developmen	t/Growth				
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	4350438					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	·		High			
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical analysis was conducted.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected.		
Additional Comments:	None					
Overall Qualit	Overall Quality Determination					

Exactly Citation: Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.				
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 2	1 days	
Exposure Route,	Aquatic (fre	shwater); Water; Not determined by study	authors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route
Media, Path:				
Taxa, Species, Age:	Vertebrate; I	Fish; Pimephales promelas; Juvenile		
Health Outcome:	Developmen	nt/Growth		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	4350438			
Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.
Domain 2: Test Design				
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
			2011	Received to study groups
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose
		Spacing of Exposure Levels	0	response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 1: Test Organis	m			
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 13: Metric 14:	Acclimatization and Pretreatment	e	The fish were acclimatized to lab conditions.
	MEUIC 14:	Conditions	High	
	Metric 15:	Number of Organisms and	Low	There were two replicates with 10 organisms per replicate.
		Replicates per Group		
Domain 5: Outcome As		· · · · · · · · · · · · · · · · · · ·		
	Metric 16:	Adequacy of Test Conditions	N/A	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	M (10	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
	Metric 18:	Assessment	mgn	Outcomes were assessed consistently across study groups.

			nueu nom p	revious page			
Study Citation:	Belanger, S.	E. (1985). Functional and pathological res	ponses of sel	ected aquatic organisms to chrysotile asbestos.			
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	authors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Vertebrate; F	Fish; Pimephales promelas; Juvenile					
Health Outcome:	Developmen	Development/Growth					
Chemical:	chrysotile (se	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Con Metric 19:	ntrol Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	High	Statistical analysis was conducted.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected.			
Additional Comments:	None						
Overall Qualit	ty Detern	nination	High				

Study Citation:	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.								
Duration:		ation: > 21 days; Exposure Duration: > 2	•	1 · 1 / · · · · · · · · · · · · · · · ·					
Exposure Route,	Aquatic (fre	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Vertebrate; Fish; <i>Pimephales promelas</i> ; Adult ADME (biotransformation) chrysotile (serpentine) (CASRN 12001-29-5)							
Media, Path: Taxa, Species, Age:	Vartabrata								
Health Outcome:									
Chemical:									
HERO ID:	4350438	(ensitive) (ensitive 12001 29 0)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	ice		0						
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported, and high control					
				mortality was noted.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	oractorization								
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described					
	metric /.	Preparation	mgn	in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
		Administration							
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type,					
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose					
		Spacing of Exposure Levels	0	response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.					
		Conditions	C						
	Metric 15:	Number of Organisms and	Low	The were two replicates with 10 organisms per replicate.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	tinued on nex	t nage					

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		conti	nued from p	revious page		
Study Citation:	Belanger, S.	E. (1985). Functional and pathological resp	ponses of sel	ected aquatic organisms to chrysotile asbestos.		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Vertebrate; F	Fish; Pimephales promelas; Adult				
Health Outcome:	ADME (biotransformation)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	4350438					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	*					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	N/A	Statistical analysis is typically not conducted for ADME studies.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected.		
Additional Comments:	None					
Overall Qualit	v Detern	nination	High			

Study Citation: Duration: Exposure Route,	Overall Dura	E. (1985). Functional and pathological responsion > 21 days; Exposure Duration: > 21 days; by automatic by study automatic	lays	e organisms to chrysotile asbestos. nterest in exposure water, but unable to determine exact uptake route)
Media, Path: Taxa, Species, Age:		Fish; Pimephales promelas; Adult		
Health Outcome:	Mortality			
Chemical: HERO ID:	chrysotile (se 4350438	erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported to have high mortal- ity.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described
	Wieule 7.	Preparation	Ingn	in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose
		Spacing of Exposure Levels		response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisı	m			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.
	Metric 15:	Conditions Number of Organisms and	Low	There were two replicates with 15 organisms per replicate.
		Replicates per Group		
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		С	ontinued on next page	

		c	ontinued from previous pa	age			
Study Citation:	Belanger, S.	E. (1985). Functional and pathological resp	onses of selected aquatic or	ganisms to chrysotile asbestos.			
Duration:		ation: > 21 days; Exposure Duration: > 21 d	•				
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study au	thors (i.e., chemical of inte	rest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Vertebrate; I	Fish; Pimephales promelas; Adult					
Health Outcome:	Mortality						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	4350438						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Demain (; Cenferradia	- Westahle Ca	-41					
Domain 6: Confounding			TT: 1				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present		-					
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected except the high control mortality			
Additional Comments:	None						
Overall Quali	ty Detern	nination	Uninformative				

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Study Citation: Duration: Exposure Route,	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)							
Media, Path: Taxa, Species, Age:	Vertebrate; Fish; <i>Pimephales promelas</i> ; Juvenile Mortality							
Health Outcome:								
Chemical: HERO ID:	chrysotile (s 4350438	erpentine) (CASRN 12001-29-5)						
Domain		Metric	Rating	Comments				
Domain 1: Test Substanc	e							
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.				
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.				
	Metric 3:	Test Substance Purity	Low	the purity and/or grade of test substance were not reported.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Cha	aracterization							
1	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.				
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
	Metric 9:	Administration Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.				
	Metric 10:	Exposure Duration and Frequency	High	The duration of the exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
Domain 4: Test Organism	n							
Domain 1. 10st Organish	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment	High	The fish were acclimatized to lab conditions.				
	Metric 15:	Conditions Number of Organisms and	Low	There were two replicates with 15 organisms per replicate.				
		Replicates per Group						
Domain 5: Outcome Ass	essment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.				
			Continued on next page					

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			continued from previous pa	ige			
Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Belanger, S. E. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos. Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age:	Vertebrate; Fish; Pimephales promelas; Juvenile						
Health Outcome:	Mortality						
Chemical: HERO ID:	chrysotile (serpentine) (CASRN 12001-29-5) 4350438						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in the growth table.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Study authors reported a reasonable response with nothing unexpected.			
Additional Comments:	None						
Overall Quali	ty Detern	nination	Uninformative				

Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment International 9(3):173-176.						
D							
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route, Media, Path:	Aquatic (fre	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
,	Vertebrate; Fish; <i>Poecilia formosa</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Taxa, Species, Age: Health Outcome:							
Chemical:	1	Hepatic/Liver chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3582159						
Domain	5562159	Metric	Rating	Comments			
Domain 1: Test Substan		Metric	Katting	Comments			
Domain 1. Test Substan	Metric 1:	Test Substance Identity	Medium	The chemical was identified by name; type - Johns Manville No. 7RF02.			
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.			
	Metric 2: Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.			
	Wiettie 5.	Test Substance I unity	Low	The purity and/of grade of lest substance were not reported.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Medium	The number of lesions were noted, but mortalities were not reported.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Cl	naracterization						
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described			
		Preparation		in adequate detail.			
	Metric 8:	Consistency of Exposure	High	Details of the exposure administration were reported, and exposures were administered			
		Administration	_	consistently across study groups.			
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Study authors reported a long test duration with a closed system. This resulted in a rating downgrade.			
	Metric 11:	Number of Exposure Groups/	Medium	There were only three exposure levels, thus the downgrade.			
		Spacing of Exposure Levels		· - •			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.			
Domain 4: Test Organis		Test Organism Characteristics	τ				
	Metric 13:	Test Organism Characteristics	Low	The source of the test animals was not reported.			
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.			
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	The number of test organism replicates was only two.			
Domain 5: Outcome As							
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.			
		<i>a</i>	tinued on nex				

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Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environmen International 9(3):173-176.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:	Vertebrate; Fish; <i>Poecilia formosa</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Taxa, Species, Age:							
Health Outcome:	Hepatic/Liver						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3582159						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.			
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	Low	Statistical analysis was not conducted. The study focused on pathology findings.			
	Metric 22:	Reporting of Data	Medium	Results were described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Qualit	t v Deter r	nination	Low				

Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment						
Duration:	International 9(3):173-176. Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:	riquare (ire						
Taxa, Species, Age:	Vertebrate; I	Fish; Poecilia formosa; Not Applicable (e.ş	g., fungi or alg	gae studies) or Not Reported			
Health Outcome:	Renal/Kidne	еу					
Chemical:	•	erpentine) (CASRN 12001-29-5)					
HERO ID:	3582159						
Domain		Metric	Rating	Comments			
Domain 1: Test Substanc							
	Metric 1:	Test Substance Identity	Medium	The chemical was identified by name; type - 7RF02.			
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Medium	The number of lesions were noted, but mortalities were not reported.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	High				
	Metric 7.	Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.			
	Metric 8:	Consistency of Exposure	High	Details of the exposure administration were reported, and exposures were administered			
		Administration	U	consistently across study groups.			
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Study authors reported a long test duration with a closed system. This resulted in a			
	Wieute 10.	Exposure Duration and Frequency	Wiedium	rating downgrade.			
	Metric 11:	Number of Exposure Groups/	Medium	There were only three exposure levels, thus the downgrade.			
	1	Spacing of Exposure Levels	27/4				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.			
Domain 4: Test Organisn	n						
U	Metric 13:	Test Organism Characteristics	Low	The source of the test animals was not reported.			
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.			
	Metric 15:	Conditions Number of Organisms and	Low	The number of test organism replicates was only two.			
	Metric 15:	Replicates per Group	LUW	The number of test organism replicates was only two.			
Domain 5: Outcome Ass		A degree of Test Car ditions	T				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.			
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but			
				few details were provided.			
		Cont	tinued on nex	t page			

Study Citation:						
study chution.	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment International 9(3):173-176.					
Duration:		tion: > 21 days; Exposure Duration: > 21	days			
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:	,	· · ·				
Taxa, Species, Age:	Vertebrate; F	ish; Poecilia formosa; Not Applicable (e.g	., fungi or al	gae studies) or Not Reported		
Health Outcome:	Renal/Kidne	y				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3582159					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for the outcome assessment were		
		Assessment		limited.		
Demein (. Cenferralia		- 4 1				
Domain 6: Confounding	0	Confounding Variables in Test	T			
	Metric 19:		Low			
		e	2011	The study did not provide enough information to allow a comparison of environmental conditions		
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	The study did not provide enough information to allow a comparison of environmental conditions. There was no information in the study to suggest differences among groups.		
Domain 7: Data Presen	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure		conditions.		
Domain 7: Data Presen	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure		conditions.		
Domain 7: Data Presen	Metric 20: tation and Anal	Design and Procedures Outcomes Unrelated to Exposure ysis	Medium	conditions. There was no information in the study to suggest differences among groups. Statistical analysis was not conducted, but raw data were provided. The study focused		
Domain 7: Data Presen	Metric 20: tation and Anal Metric 21:	Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	Medium	conditions. There was no information in the study to suggest differences among groups. Statistical analysis was not conducted, but raw data were provided. The study focused on pathology findings.		
Domain 7: Data Presen Additional Comments:	Metric 20: tation and Anal Metric 21: Metric 22:	Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods Reporting of Data	Medium Low High	conditions. There was no information in the study to suggest differences among groups. Statistical analysis was not conducted, but raw data were provided. The study focused on pathology findings. Data for exposure-related findings were presented for each treatment and control group.		

Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment					
Duration: Exposure Route, Media, Path:	Overall Dura	9(3):173-176. ation: > 21 days; Exposure Duration: > 2 shwater); Water; Not determined by study		chemical of interest in exposure water, but unable to determine exact uptake route)		
Taxa, Species, Age: Health Outcome:	Vertebrate; F Musculoskel	Fish; <i>Poecilia formosa</i> ; Not Applicable (e.	g., fungi or alg	gae studies) or Not Reported		
Chemical: HERO ID:		erpentine) (CASRN 12001-29-5)				
Domain	5562159	Metric	Rating	Comments		
Domain 1: Test Substance	e	metre	Runng	connens		
	Metric 1:	Test Substance Identity	Medium	The chemical was identified by name; type - Johns Manville No. 7RF02.		
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.		
Domain 2: Test Design						
C C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Medium	The number of lesions were noted, but mortalities were not reported.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Cha	racterization					
·	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Details of the exposure administration were reported, and exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Study authors reported a long test duration with a closed system. This resulted in a rating downgrade.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	Medium	There were only three exposure levels, thus the downgrade.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.		
Domain 4: Test Organism	ı					
0	Metric 13:	Test Organism Characteristics	Low	The source of the test animals was not reported.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.		
	Metric 15:	Number of Organisms and Replicates per Group	Low	The number of test organism replicates was only two.		
Domain 5: Outcome Asse	essment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.		
		Cont	tinued on nex	t page		

			nucu nom p			
Study Citation:			effects of ch	ronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environmen		
		19(3):173-176.				
Duration:		ation: > 21 days; Exposure Duration: > 21	•			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Vertebrate; Fish; <i>Poecilia formosa</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Musculoskeletal					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3582159					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for the outcome assessment were		
		Assessment		limited.		
Domain 6: Confounding						
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Presenta	ation and Anal	lysis				
	Metric 21:	Statistical Methods	Low	Statistical analysis was not conducted. The study focused on pathology findings.		
	Metric 22:	Reporting of Data	Medium	Results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					
ridditional Comments.	1,010					
Overall Qualit	v Deterr	nination	Low			
Vivian Quant						

Study Citation:	Woodhead, A	A. D., Setlow, R. B., Pond, V. (1983). The	effects of chr	conic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environmen					
Duration:		19(3):173-176. ation: > 21 days; Exposure Duration: > 2	1 dava						
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	Aquatic (fies	sinwater), water, Not determined by study	autions (i.e., o	chemical of interest in exposure water, but unable to determine exact uptake route)					
Faxa, Species, Age:									
Health Outcome:	Cardiovascu								
Chemical:		erpentine) (CASRN 12001-29-5)							
HERO ID:	3582159	•							
Domain		Metric	Rating	Comments					
Domain 1: Test Substanc									
	Metric 1:	Test Substance Identity	Medium	The chemical was identified by name; type - Johns Manville No. 7RF02.					
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The number of lesions was noted, but mortalities were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Cha	aracterization								
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described					
		Preparation	8	in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Details of the exposure administration were reported, and exposures were administered					
		Administration		consistently across study groups.					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Study authors reported a long test duration with a closed system. This resulted in a					
	Methe 10.	Exposure Duration and Frequency	wicdium	rating downgrade.					
	Metric 11:	Number of Exposure Groups/	Medium	There were only three exposure levels, thus the downgrade.					
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.					
	Weute 12.	Testing at or below solubility Emilt	14/14						
Domain 4: Test Organism									
	Metric 13:	Test Organism Characteristics	Low	The source of the test animals was not reported.					
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.					
	Metric 15:	Number of Organisms and	Low	The number of test organism replicates was only two.					
		Replicates per Group							
Domain 5: Outcome Ass	essment								
Soman 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.					
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.					
		C	tinued on nex						

			-			
Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment International 9(3):173-176.					
Duration:		tion: > 21 days; Exposure Duration: > 21	days			
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:	1 、		· · · · ·			
Taxa, Species, Age:	Vertebrate; F	ish; Poecilia formosa; Not Applicable (e.g	., fungi or al	gae studies) or Not Reported		
Health Outcome:	Cardiovascu	lar				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3582159					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for the outcome assessment were		
		Assessment		limited.		
Domain 6: Confounding	·					
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	M (: 20	Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	Low	Statistical analysis was not conducted, but raw data were provided. The study focused on pathology findings.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					

Study Citation:	Woodhead, A. D., Setlow, R. B., Pond, V. (1983). The effects of chronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment International 9(3):173-176.					
Duration: Exposure Route, Media, Path:	Overall Dura	ation: > 21 days; Exposure Duration: > 2		chemical of interest in exposure water, but unable to determine exact uptake route)		
Taxa, Species, Age: Health Outcome:	Vertebrate; Fish; <i>Poecilia formosa</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Skin and Connective Tissue chrysotile (serpentine) (CASRN 12001-29-5) 3582159					
Chemical: HERO ID:						
Domain		Metric	Rating	Comments		
Domain 1: Test Substanc						
	Metric 1:	Test Substance Identity	Medium	The chemical was identified by name; type - 7RF02.		
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Medium	The number of lesions were noted, but mortalities were not reported.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Cha	aracterization					
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Details of the exposure administration were reported, and exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Study authors reported a long test duration with a closed system. This resulted in a rating downgrade.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	Medium	There were only three exposure levels, thus the downgrade.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.		
Domain 4: Test Organisn	n					
Domain 1. Tost Organish	Metric 13:	Test Organism Characteristics	Low	The source of the test animals was not reported.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.		
	Metric 15:	Number of Organisms and Replicates per Group	Low	The number of test organism replicates was only two.		
Domain 5: Outcome Ass	essment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.		
		Cont	tinued on nex	t page		

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				nerious page		
Study Citation:			effects of ch	ronic exposure to asbestos fibers in the Amazon molly Poecilia formosa. Environment		
Duration:		19(3):173-176.	J			
		ation: > 21 days; Exposure Duration: > 21	•			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	Vartabrata: Fish: Passilia formasa: Nat Applicable (a.g., funci ar algae studies) or Nat Papartad					
Taxa, Species, Age:	Vertebrate; Fish; <i>Poecilia formosa</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Skin and Connective Tissue					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3582159					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for the outcome assessment were		
		Assessment		limited.		
Dennein (. Conformation		- 4 1				
Domain 6: Confounding			T			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	M-4-1- 20.	Design and Procedures	Madian			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	Low	Statistical analysis was not conducted. The study focused on pathology findings.		
	Metric 22:	Reporting of Data	Medium	The data was reported as "No effects were noted upon the skin."		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
		r ····································	-8			
Additional Comments:	None					
Overall Qualit	ty Detern	nination	Low			
`	v					

Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to cl									
Duration:	asbestos. Water Research 20(10):1243-1250. Overall Duration: > 21 days; Exposure Duration: > 21 days									
Exposure Route,				nical of interact in avacuum water, but unable to determine avact untake route)						
Media, Path:	Aquatic (field	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)								
Taxa, Species, Age:	Invertebrate	; Mollusks; Corbicula fluminea; Juvenile								
Health Outcome:	Mortality	, Monusks, Corbicula juminea, Juvenne								
Chemical:	2	erpentine) (CASRN 12001-29-5)								
HERO ID:	3093856									
Domain		Metric	Rating	Comments						
Domain 1: Test Substand	ce									
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.						
	Metric 2:	Test Substance Source	High	The source was stated in the acknowledgements section.						
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.						
Domain 2: Test Design										
Domain 2. Test Design	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized for preparing the asbestos exposure or whether the control group also received the same solvent.						
	Metric 5:	Negative Control Response	High	No mortality was observed in the control group for summer-collected or winter- collected clams.						
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.						
Domain 2. Euroques Ch	onostanization									
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	It was not stated what solvent type was used for asbestos fiber stocks.						
	Wietife 7.	Preparation	Wiedium	It was not stated what solvent type was used for aspestos noer stocks.						
	Metric 8:	Consistency of Exposure	High	Exposures appeared to be administered consistently.						
	Metric 9:	Administration Measurement of Test Substance Concentration	High	Asbestos concentrations in the water were measured at day 0 and day 30 via the TEM method.						
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was appropriate for the endpoint (mortality).						
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five concentrations covering six orders of magnitude and a control group were include in the study.						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.						
Domain 4: Test Organisi	m Metric 13:	Test Organism Characteristics	Medium	There are minor reconnections shout the course (wild cought) of the test second						
	Metric 13: Metric 14:	Test Organism Characteristics Acclimatization and Pretreatment	High	There are minor reservations about the source (wild caught) of the test organisms. The test organisms were acclimatized to test conditions for 7 days.						
	wieute 14:	Conditions	nigii	The test organisms were acclimatized to test conditions for / days.						
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were 10 clams per group, but no replicates were reported. In the results section, i was reported that 120 and 60 clams were utilized for 10(8) fiber group for summer and winter-collected clams, respectively.						

Domain 5: Outcome Assessment

Continued on next page ...

			*				
Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:							
Taxa, Species, Age:	Invertebrate	Mollusks; Corbicula fluminea; Juvenile					
Health Outcome:	Mortality	, Monusks, Coroleulu jumineu, Juvenne					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093856	erpendine) (CASKIN 12001-29-3)					
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient conter were analyzed on days 0 and 30 of the experiment. Temperature was measured.			
	Metric 17:	Outcome Assessment Methodology	Medium	It was unclear how often clams were monitored for mortality (or how mortality was determined).			
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for outcome assessment were con- fusing, limited, or not reported.			
Domain 6. Confounding	Wariahla Ca	ntanl					
Domain 6: Confounding	Metric 19:		TT: -1-				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental condition			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and control. 2/120 and 3/60 clams died at the higher exposure level for summer-collected and winter-collected clams, respectively.			
Domain 7. Data Proconte	ation and Anal	unio					
Domain 7: Data Presenta	Metric 21:	Statistical Methods	N/A	These wass reporting for diago correspond 11 groups around a fam most - 141 in the high			
	Metric 21:	Statistical Methods	IN/A	There were negative findings across all groups except a few mortalities in the high exposure group.			
	Metric 22:	Reporting of Data	Medium	Results were described in the text. Timing of mortalities in the high exposure group were not reported.			
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.			
Additional Comments:	This form ap	pplies to both summer-collected and winter-	collected clams.				
Overall Qualit	v Deterr	nination	Medium				

Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.								
Duration: Exposure Route, Media, Path:		ation: > 21 days; Exposure Duration: > 21 shwater); Water; Not determined by study a		nical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age:		Invertebrate; Mollusks; Corbicula fluminea; Juvenile							
Health Outcome: Chemical: HERO ID:	Respiratory chrysotile (s 3093856	sotile (serpentine) (CASRN 12001-29-5)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substand									
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.					
	Metric 2:	Test Substance Source	High	The source was stated in the acknowledgements.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
-	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized for preparing the asbestos exposure or whether the control group received the same solvent.					
	Metric 5:	Negative Control Response	High	The control response reported in the text.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Cha	aracterization								
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media Preparation	Medium	It was not stated what solvent type was used for asbestos fiber stocks.					
	Metric 8:	Consistency of Exposure Administration	High	The exposures appeared to be administered consistently across groups.					
	Metric 9:	Measurement of Test Substance Concentration	High	Asbestos concentrations in the water were measured at day 0 and day 30 via the TEM method.					
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was appropriate for the endpoint (size and surface area of locules in the gill lamellae).					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five concentrations covering six orders of magnitude and a control group were included in the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organisi	n Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 13: Metric 14:	Acclimatization and Pretreatment	High	There are minor reservations about the source (wild caught) of the test organisms. The test organisms were acclimatized to test conditions for 7 days.					
	MEUIC 14:	Conditions	ingn	The test organisms were accumatized to test conditions for / days.					
	Metric 15:	Number of Organisms and Replicates per Group	Low	It was unclear how many clams were analyzed by ultrastructural analysis. The methods generally states clams were grouped by 10 but does not state replicates.					
Domain 5: Outcome Ass		A do any of Track C 111	TT: 1						
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.					
		Court!	nued on next pa						

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			ded from previ	ions hade		
Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Invertebrate; Mollusks; Corbicula fluminea; Juvenile					
Health Outcome:	Respiratory					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093856					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology for ultrastructural analysis was stated.		
	Metric 18:	Consistency of Outcome Assessment	High	The outcome was assessed at the conclusion of the exposure.		
Domain 6: Confounding	g / Variable Co	ntrol				
c	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions		
		Design and Procedures				
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and the control. 2/120 and 3/60 clams died at the highest exposure level for summer-collected and winter-collected clams, respectively.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Planimetric analysis of gill tissue was described in text. P-values were stated in the results for significance.		
	Metric 22:	Reporting of Data	High	The results were described in the text. The control and high exposure group were sam- pled for this analysis. A representative illustration was shown in Figure 4.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, and variability of the data was described in the text.		
Additional Comments:	This form ap	oplies to the gill locules of summer-collected	and winter-col	lected clams.		
Overall Qualit	ty Deterr	nination	Medium	L		

Study Citation:		E., Cherry, D. S., J, Cairns, J. R. (1986) ater Research 20(10):1243-1250.	. Seasonal beha	vioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile
Duration: Exposure Route, Madia Dath:	Overall Dura	ation: > 21 days; Exposure Duration: > 21		nical of interest in exposure water, but unable to determine exact uptake route)
Media, Path: Faxa, Species, Age:	Invertebrate	; Mollusks; Corbicula fluminea; Juvenile		
Health Outcome:	Developmen			
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3093856			
Domain		Metric	Rating	Comments
Domain 1: Test Substanc			_	
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.
	Metric 2:	Test Substance Source	High	The source was stated in the acknowledgements section.
	Metric 3:	Test Substance Purity	Low	The Purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized for preparing the asbestos exposure or whether the control group received the same solvent.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Figure 3.
	Metric 6:	Randomized Allocation	Low	It was not reported how the organisms were allocated into study groups.
Domain 3: Exposure Cha		Ennering and Sectors (East Madia	Madian	
	Metric 7:	Experimental System/Test Media Preparation	Medium	It was not stated what solvent type was used for asbestos fiber stocks.
	Metric 8:	Consistency of Exposure	High	The exposures appeared to be administered consistently.
	Metric 9:	Administration Measurement of Test Substance Concentration	High	Asbestos concentrations in the water were measured at day 0 and day 30 via the TEM method.
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was adequate for the endpoint (shell growth).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five concentrations covering six orders of magnitude and a control group were included in the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4. Toot Orres				
Domain 4: Test Organisr	n Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 13: Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 7 days.
		Conditions	C	
	Metric 15:	Number of Organisms and	Low	Authors did not report how many clams were included in Figure 3. It was stated in
		Replicates per Group		methods that clams were grouped by 10 without mention of replicates.
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient conten were analyzed on days 0 and 30 of the experiment. Temperature was measured.

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		contin	ued from previ	ous page		
Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.					
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study an	uthors (i.e., chem	nical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:		Mollusks; Corbicula fluminea; Juvenile				
Health Outcome:	Development/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093856					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome methodology for determining shell growth was adequately described. Change in length was presented rather than initial and final lengths for all treatment groups.		
	Metric 18:	Consistency of Outcome Assessment	Medium	It was unclear how often measurements were taken.		
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and the control. 2/120 and 3/60 clams died at the highest exposure level for summer-collected and winter-collected clams, respectively.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Figure 3.		
	Metric 23:	Explanation of Unexpected Outcomes	High	No unexpected outcomes were reported. Variability of the data was presented.		
Additional Comments:	This forms a	pples to the shell growth of winter-collected	l and summer-co	llected clams.		
Overall Qualit	ty Deterr	nination	Medium			

Study Citation:			6). Seasonal	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile					
Duration	asbestos. Water Research $20(10)$:1243-1250. Overall Duration: > 21 days; Exposure Duration: > 21 days Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)								
Duration: Exposure Route,									
Media, Path:	Aquatic (IIC	sitwater), water, not determined by study	autions (n.e.,	enclinear of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula fluminea; Juvenile							
Health Outcome:	Developmen								
Chemical:	•	erpentine) (CASRN 12001-29-5)							
HERO ID:	3093856								
Domain		Metric	Rating	Comments					
Domain 1: Test Substanc			-						
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.					
	Metric 2:	Test Substance Source	High	The source was stated in the acknowledgements section.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
2 onnun 21 1000 2 oorgi	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized for preparing the asbestos exposure or whether the control group received the same solvent.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Figure 3 (weight gain) and Table 1 (wet weight, dry weight, and tissue water content).					
	Metric 6:	Randomized Allocation	Low	It was not reported how the organisms were allocated into study groups.					
Domain 3: Exposure Cha	Metric 7:	Engening and all Southerns (Teach Mardia	Mallin						
	Metric 7:	Experimental System/Test Media Preparation	Medium	It was not stated what solvent type was used for asbestos fiber stocks.					
	Metric 8:	Consistency of Exposure Administration	High	The exposures appeared to be administered consistently.					
	Metric 9:	Measurement of Test Substance Concentration	High	Asbestos concentrations in the water were measured at day 0 and day 30 via the TEM method.					
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was adequate for the endpoint (weight change, water tissue con- tent).					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five concentrations covering six orders of magnitude and a control group were included in the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble					
Domain 4: Test Organisr			M. 1	man i ji jiji zini tavasti i					
	Metric 13: Metric 14:	Test Organism Characteristics Acclimatization and Pretreatment	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 14:	Conditions	High	The test organisms were acclimatized to test conditions for 7 days.					
	Metric 15:	Number of Organisms and Replicates per Group	Low	Authors did not report how many clams were included in Figure 3. The n for Table 1 is 15 and 10 for summer-collected and winter-collected clams, respectively.					
Domain 5: Outcome Ass	essment								
2 chian 5. Outcome Abs		~	tinued on nex						

			nucu nom p	
Study Citation:	•	E., Cherry, D. S., J, Cairns, , J. R. (1986 ater Research 20(10):1243-1250.). Seasonal	behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile
Duration:		ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route, Media, Path:				chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Invertebrate:	Mollusks; Corbicula fluminea; Juvenile		
Health Outcome:	Developmen	, ,		
Chemical:	•	erpentine) (CASRN 12001-29-5)		
HERO ID:	3093856			
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome methodology for determining weight and tissue water content were ade- quately described.
	Metric 18:	Consistency of Outcome	Medium	It was unclear how often measurements were taken.
		Assessment		
Domain 6: Confounding	/ Variable Co	ntrol		
2	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and the control. 2/120 and 3/60 clams died at the
			U	highest exposure level for summer-collected and winter-collected clams, respectively.
Domain 7: Data Present	ation and Anal	veie		
Domain 7. Data i lesent	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 21:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group
		Topotang of Dam	111511	in Figure 3 and Table 1.
	Metric 23:	Explanation of Unexpected Outcomes	High	No unexpected outcomes were reported. Variability of the data was presented.
Additional Comments:	This form ap	pplies to weights and tissue water in winter-	-collected an	d summer-collected clams.
Overall Qualit	ty Detern	nination	High	

Study Citation:			6). Seasonal	behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotil
Destination		ter Research 20(10):1243-1250.	1 1	
Duration: Exposure Route,		ation: > 21 days; Exposure Duration: > 2		chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	Aquatic (fres	silwater), water, Not determined by study	autions (n.e.,	chemical of interest in exposure water, out unable to determine exact uptake route)
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula fluminea; Juvenile		
Health Outcome:	Behavioral			
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)		
HERO ID:	3093856			
Domain		Metric	Rating	Comments
Domain 1: Test Substanc			-	
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.
	Metric 2:	Test Substance Source	High	The source was reported in the acknowledgements section.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized for preparing the asbestos exposure or whether the control group received the same solvent.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Figure 2 and in the text.
	Metric 6:	Randomized Allocation	Low	It was not reported how the organisms were allocated into study groups.
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Medium	
	Meuric 7.	Preparation	Ivieuluiii	It was not stated what solvent type was used for the asbestos fiber stocks.
	Metric 8:	Consistency of Exposure	High	The exposures appeared to be administered consistently.
	Metric 9:	Administration Measurement of Test Substance Concentration	High	The asbestos concentrations in the water were measured at day 0 and day 30 via the TEM method.
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was appropriate for determining daily siphoning activity.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five concentrations covering six orders of magnitude and a control group were included in the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisn	n			
Domain 4. Test Organish	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 7 days.
		Conditions	111.511	The test of gallions were decimilated to test conditions for 7 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were 10 clams per group with no replicates reported. In the results section, it was reported that 120 and 60 clams were utilized for 10(8) fiber group for summer and winter-collected clams, respectively.
Domain 5: Outcome Ass	essment			
		Cont	tinued on nex	t nogo

				previous page		
Study Citation:	•	E., Cherry, D. S., J, Cairns, J. R. (1986) ater Research 20(10):1243-1250.). Seasonal	behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile		
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:	1					
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula fluminea; Juvenile				
Health Outcome:	Behavioral	-				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093856					
Domain		Metric	Rating	Comments		
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.		
	Metric 17:	Outcome Assessment Methodology	High	"Two hours after feeding (~10 am), the number of clams in each chamber with valves parted were counted as an indication of siphoning activity"		
	Metric 18:	Consistency of Outcome Assessment	High	Siphoning activity was determined two hours after feeding.		
Domain 6: Confounding	. / Variable Co	ntrol				
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
	Methe 17.	Design and Procedures	mgn	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and the control. 2/120 and 3/60 clams died at the		
				highest exposure level for summer-collected and winter-collected clams, respectively.		
Domain 7: Data Present	ation and Anal	veie				
2 chain / Duta i lobolit	Metric 21:	Statistical Methods	High	Statistical methods were well-described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented in Figure 2 for each treatment and		
				control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This form ap	pplies to the siphoning activity of summer a	nd winter-co	ollected clams.		
Overall Qualit	y Detern	nination	High			

Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.					
Duration:		atter Research 20(10):1243-1250. ation: > 21 days; Exposure Duration: > 2	1 days			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Invertebrate	Mollusks; Corbicula fluminea; Juvenile				
Health Outcome:		(ransformation)				
Chemical:	· · · · · · · · · · · · · · · · · · ·	erpentine) (CASRN 12001-29-5)				
HERO ID:	3093856	(enski) (enski) (2001-29-3)				
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce					
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.		
	Metric 2:	Test Substance Source	High	The source was stated in the acknowledgements section.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.		
Domain 2: Test Design						
Domain 2. Test Design	Metric 4:	Negative Controls	Low	A control group was included in the study. It was not reported what solvent was utilized		
	Mettie 1.		Low	for preparing the asbestos exposure or whether the control group received the same		
				solvent.		
	Metric 5:	Negative Control Response	High	The biological response of the control group was reported in Table 2 and in the text as below detection limit.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Ch	aracterization					
1	Metric 7:	Experimental System/Test Media	Medium	It was not stated what solvent type was used for asbestos fiber stocks.		
		Preparation		71		
	Metric 8:	Consistency of Exposure	High	The exposures appeared to be administered consistently across groups.		
		Administration	C C			
	Metric 9:	Measurement of Test Substance	High	Asbestos concentrations in the water were measured at day 0 and day 30 via the TEM		
		Concentration		method.		
	Metric 10:	Exposure Duration and Frequency	High	The 30 day exposure was appropriate for endpoint (fiber burdens).		
	Metric 11:	Number of Exposure Groups/	High	Five concentrations covering six orders of magnitude and a control group were included		
		Spacing of Exposure Levels		in the study.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.		
Domain 4: Test Organisi	m					
0	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.		
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 7 days.		
		Conditions	0			
	Metric 15:	Number of Organisms and	Low	N was reported in Table 2 as 2-4, and three clams were utilized for Table 3 data.		
		Replicates per Group				
Domain 5: Outcome Ass	sessment					
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or-		
	Meure 10.	racquie, or rest conditions	mgn	ganism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.		
		<i>a</i>	inued on nex	· · ·		

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Study Citation:		Belanger, S. E., Cherry, D. S., J, Cairns, J. R. (1986). Seasonal behavioral and growth changes of juvenile Corbicula-fluminea exposed to chrysotile asbestos. Water Research 20(10):1243-1250.					
Duration:		ation: > 21 days; Exposure Duration: > 21	davs				
Exposure Route,			2	chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:	1						
Faxa , Species, Age:	Invertebrate;	Mollusks; Corbicula fluminea; Juvenile					
Health Outcome:	ADME (biotransformation)						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093856						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	High	Asbestos fiber analysis in tissue was adequately described.			
	Metric 18:	Consistency of Outcome	High	The outcome was determined at the conclusion of the study.			
		Assessment					
		4 1					
Domain 6: Confounding	·		TT: -1-				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for all doses and the control. 2/120 and 3/60 clams died at the			
	Wietife 20.	Outcomes officiated to Exposure	Ingn	highest exposure level for summer-collected and winter-collected clams, respectively.			
Domain 7: Data Presenta	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	The statistical method for fiber size distribution was described.			
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were described for the control and two treatment groups in Table 2 and for the high treatment group only in Table 3.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Authors state that fibers in the visceral tissue may not have been embedded in the tissue but present only in the gastointestinal lumen.			

Study Citation: Duration:	Journal of Fi Overall Dura	isheries and Aquatic Sciences 43(1):43-52 ation: 0 - 4 days (0-96h); Exposure Durati	on: 0 - 4 days						
Exposure Route,	Aquatic (free	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult							
Media, Path:								
Taxa, Species, Age:									
Health Outcome: Chemical:	Behavioral								
HERO ID:	3093600	erpentine) (CASRN 12001-29-5)							
	3093000								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan		— • • • • •							
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design	M - 4	Nagative Cantonla	II: -h						
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch									
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Preparation Consistency of Exposure	High	*					
	wieure of	Administration	High	Exposures were administered consistently across study groups.					
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
		Concentration		- • • •					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.					
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose					
		Spacing of Exposure Levels		response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	m								
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 13.	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.					
	Meule 14.	Conditions	ingn	The test organisms were accumulated to test conditions for 14 days.					
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were no biological replicates and only 10 organisms per treatment.					

Continued on next page ...

Study Citation:		Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian					
Duration:		sheries and Aquatic Sciences 43(1):43-52. ation: 0 - 4 days (0-96h); Exposure Duration	n 0 1 day	a (0.06b)			
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:	Aquatic (iie)	sinwater), water, not determined by study a	iumors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)			
Taxa, Species, Age:	Invertebrate:	Mollusks; Corbicula sp.; Adult					
Health Outcome:	Behavioral	r,					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093600						
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	g / Variable Cor	ntrol					
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
		Design and Procedures					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	veic					
Domain 7. Data Present	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
			111511				
Additional Comments:	This portion	of the study monitored siphoning activity i	n fed organi	isms.			
Overall Qualit	tv Deterr	nination	High				

Study Citation: Duration: Exposure Route, Madia Bathy	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian Journal of Fisheries and Aquatic Sciences 43(1):43-52. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h) Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (bio	; Mollusks; <i>Corbicula sp.</i> ; Adult transformation) erpentine) (CASRN 12001-29-5)				
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Medium High	The test substance was identified, and the specific form was characterized. The test substance identity was analytically characterized and verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.		
Domain 2: Test Design						
1000 2 001gh	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Ch	aracterization					
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by study the author.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.		
Domain 4: Test Organisı	n					
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.		
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	No biological replicates were reported.		
Domain 5: Outcome Ass	accmant					
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.		
		Cont	tinued on nex	at page		

			1			
Study Citation:	-	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian Journal of Fisheries and Aquatic Sciences 43(1):43-52.				
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration		s (0-96h)		
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:		· · ·				
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult				
Health Outcome:	ADME (biotransformation)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding						
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	veic				
Domain 7. Data i resent	Metric 21:	Statistical Methods	N/A	Statistical methods are typically not used for accumulation assessments.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not presented for each treatment, just the two		
		Reporting of Data	Lon	high cones and control.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	This work'	- f 4h				
Additional Comments:	i his portion	of the study assessed accumulation in the g	gills and vise	cera of organisms that were red.		
	w Dotow	nination	Ulah			
Overall Qualit	ly Detern	mation	High			

Study Citation: Duration: Exposure Route, Media, Path:	Journal of F Overall Dur	isheries and Aquatic Sciences 43(1):43-52 ation: 0 - 4 days (0-96h); Exposure Duration	on: 0 - 4 days	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian (0-96h) chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Invertebrate	Mollusks; Corbicula sp.; Adult		
Health Outcome:	Mortality	-		
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3093600			
Domain		Metric	Rating	Comments
Domain 1: Test Substar	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Desi-				
Domain 2: Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable for
			Ŧ	reported outcomes; survival outcomes were not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cl	haracterization			
-	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	sm			
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Conditions Number of Organisms and	Low	No biological replicates were reported.
		Replicates per Group		
Domain 5: Outcome As	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Cont	inued on nex	t page

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	Dolongor S	E Charmy D S I Cairna I D (1096)	Untaka of	f chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian
Study Citation:		sheries and Aquatic Sciences 43(1):43-52.	Uptake of	chrysothe aspestos noers afters grown and reproduction of Astatic claims. Canadia
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	n: 0 - 4 days	s (0-96h)
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	1			
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult		
Health Outcome:	Mortality			
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)		
HERO ID:	3093600			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment		
		-		
Domain 6: Confounding				
Domain 6: Confounding	y / Variable Con Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.
Domain 6: Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	U	
Domain 6: Confounding		Confounding Variables in Test	High High	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.
	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	U	
	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	U	
Domain 6: Confounding	Metric 19: Metric 20: ation and Anal	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	High	There were no differences among groups. No statistical analysis was performed because no mortality was reported. This was re-
	Metric 19: Metric 20: ation and Anal Metric 21:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	High N/A	There were no differences among groups. No statistical analysis was performed because no mortality was reported. This was reported in the text. Data for exposure-related findings were not shown for each treatment and control group,

Study Citation: Duration: Exposure Route, Madia Both:	Journal of F Overall Dura	isheries and Aquatic Sciences 43(1):43-52 ation: 0 - 4 days (0-96h); Exposure Durati	on: 0 - 4 days	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian (0-96h) chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (bio	; Mollusks; <i>Corbicula sp.</i> ; Adult transformation) erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce		U	
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Medium High	The test substance was identified, and the specific form was characterized. The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisi	n			
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Ass	essment	- · ·		
Domain J. Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Cont	tinued on nex	at page

Study Citation:	-	-	. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian		
		sheries and Aquatic Sciences 43(1):43-52.				
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	•			
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (i.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult				
Health Outcome:	ADME (biotransformation)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding		ntrol				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Presenta	ation and Anal	veic				
Domain 7. Data Fresenta	Metric 21:	Statistical Methods	N/A	Statistical methods are traigably not used for accumulation accomments		
				Statistical methods are typically not used for accumulation assessments.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not presented for each treatment, just the two high concs and the control.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	TTI ' ('					
Additional Comments:	i his portion	of the study was on the accumulation of as	bestos in the	e gills and viscera in organisms that were not fed.		
011 0114		······································	TT! _ 1			
Overall Qualit	y Detern	nination	High			

Study Citation: Duration: Exposure Route, Media, Path:	Journal of F Overall Dur	isheries and Aquatic Sciences 43(1):43-52 ation: 0 - 4 days (0-96h); Exposure Duration	on: 0 - 4 days	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadia (0-96h) chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Invertebrate	; Mollusks; Corbicula sp.; Adult		
Health Outcome:	Behavioral	-		
Chemical: HERO ID:	chrysotile (s 3093600	erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Ĩ	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
8	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Conditions Number of Organisms and	Low	There were no biological replicates and only 10 organisms per treatment.
		Replicates per Group		
Domain 5: Outcome Ass				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Cont	tinued on nex	t page

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~ ~ ~ ~						
Study Citation:			. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian		
D (1		isheries and Aquatic Sciences 43(1):43-52.	0 4 1	(0.0(1))		
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	-			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult				
Health Outcome:	Behavioral					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	v / Variable Co	ntrol				
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
	Methe 19.	-	nigii	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	High	There were no differences among groups.		
	Mettic 20.	Outcomes Onrelated to Exposure	Ingn	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	This portion	of the study monitored siphoning activity in	n organisms	that were not fed.		
Overall Qualit	tv Deterr	nination	High			

Study Citation:		E., Cherry, D. S., J, Cairns, , J. R. (1986) isheries and Aquatic Sciences 43(1):43-52		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadia			
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:	1						
Taxa, Species, Age:	Invertebrates	; Mollusks; Corbicula sp.; Adult					
Health Outcome:	Mortality						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	3093600						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan	ce						
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.			
Domain 2: Test Design							
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable for			
	Mettre 5.	Regative Control Response	Low	reported outcomes; survival outcomes were not reported.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Ch	aracterization						
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of the test media were described			
		Preparation	-	in adequate detail.			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.			
		Administration					
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for			
	methe 10.	Exposure Duration and Frequency	man	the study type.			
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were justified for a dose			
		Spacing of Exposure Levels	0	response by the study author.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Tast Ora	m						
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	Medium	There are minor recorrections about the source (wild cought) of the test excercises			
	Metric 13: Metric 14:	Acclimatization and Pretreatment		There are minor reservations about the source (wild caught) of the test organisms.			
	Metric 14:	Conditions	High	The test organisms were acclimatized to test conditions for 14 days.			
	Metric 15:	Number of Organisms and	Low	No biological replicates were reported.			
		Replicates per Group		······································			

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Study Citation:			. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadia		
Duration:	Journal of Fisheries and Aquatic Sciences 43(1):43-52. Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days					
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	Aquatic (free	sinwater), water, not determined by study a	uullois (1.c.,	enclinear of interest in exposure water, but unable to determine exact uptake route)		
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult				
Health Outcome:	Mortality					
Chemical: HERO ID:	chrysotile (so 3093600	erpentine) (CASRN 12001-29-5)				
Domain		Metric	Rating	Comments		
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.		
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.		
Domain 6: Confounding	/ Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data Present	Metric 21:	Statistical Methods	N/A	No statistical analysis was performed because there was no mortality. This was reported in the text.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not shown for each treatment and control group, but results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					
Overall Qualit	y Detern	nination	High			

Study Citation: Duration:	Journal of F	E., Cherry, D. S., J, Cairns, , J. R. (1986) isheries and Aquatic Sciences 43(1):43-52 ation: 11 - 21 days; Exposure Duration: 11		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path:	1			
Taxa, Species, Age:		; Mollusks; Corbicula sp.; Adult		
Health Outcome:		e/Teratogenic		
Chemical:	chrysotile (s 3093600	erpentine) (CASRN 12001-29-5)		
HERO ID:	3093000			
Domain Domain 1: Test Substan	100	Metric	Rating	Comments
Domain 1. Test Substan	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
2 sinum 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	naracterization			
Domain 5. Exposure er	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
Bomani 4. 10st Organis	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Conditions Number of Organisms and	Low	No biological replicates were reported.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Cont	tinued on nex	ct page

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		contir	nued from p	previous page		
Study Citation:	-	-	. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian		
D		isheries and Aquatic Sciences 43(1):43-52.	21.1			
Duration:		ation: 11 - 21 days; Exposure Duration: 11	•			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	Invertabrata: Mollusks: Corbicula sp. Adult					
Taxa, Species, Age: Health Outcome:	Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult					
Chemical:	Reproductive/Teratogenic chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
	3073000			-		
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	g / Variable Co	ntrol				
c c	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures	e			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	veic				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately, (page 54).		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were shown for each treatment and control group, and results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This portion	of the study assessed larval release and mo	rtality			
radiational comments.	This portion	or the study assessed failed include and mo	runry.			
Overall Qualit	t v Deter r	nination	High			

Study Citation:				g Asiatic clams as a biomonitor for chrysotile asbestos in public water supplies			
Duration:		the American Water Works Association $79(3)$ ation: > 21 days; Exposure Duration: > 21					
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:	Age: Invertebrate; Mollusks; <i>Corbicula sp.</i> ; species was not specified in this paper; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Taxa, Species, Age:							
Health Outcome:							
Chemical:							
HERO ID:	3584230						
Domain		Metric	Rating	Comments			
Domain 1: Test Substar							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	Medium	Grade-5 chrysotile asbestos was obtained from a commercial supplier.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Cl	haracterization						
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media	Low	Few details were provided on the experimental system, but the exposure concentration			
	metric /.	Preparation	Low	were measured.			
	Metric 8:	Consistency of Exposure	High	There was no mention of irregularities in exposure administration.			
		Administration					
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.			
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.			
	Metric 11:	Number of Exposure Groups/	Medium	There were only 2 exposure groups in the laboratory setting.			
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	This was an asbestos exposure with possible dietary exposure.			
Domain 4: Test Organis	sm						
Domani 4. Test Organis	Metric 13:	Test Organism Characteristics	Low	Just the genus and not the species was given. Laboratory test organisms were field col-			
				lected from the New River, VA.			
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions, and all pretreatment condition were the same for control and exposed organisms.			
	Metric 15:	Number of Organisms and	Medium	The numbers of test organisms and replicates were reported and sufficient to character-			
	Metrie 15.	Replicates per Group	Weddulli	ize toxicological effects.			
Domain 5: Outcome As			Ŧ				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.			
		Conti	nued on next pa	ge			
		Conti	nued on next pa	quate.			

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		conti	nued from previo	us page
Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome:	Journal of th Overall Dura Aquatic (free Invertebrate;	the American Water Works Association 79(3) ation: > 21 days; Exposure Duration: > 21 shwater); Water; Not determined by study a):69-74. days authors (i.e., chem	Asiatic clams as a biomonitor for chrysotile asbestos in public water supplies. ical of interest in exposure water, but unable to determine exact uptake route) aper; Not Applicable (e.g., fungi or algae studies) or Not Reported
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3584230			
Domain		Metric	Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups.
Domain 6: Confounding	g / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions or other non-treatment-related factors across study groups. Little detail on environmental conditions was reported at all.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to the exposure.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	None			
Overall Quali	tv Deterr	nination	Medium	

Study Citation:				chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadia						
Duration:	Journal of F	rnal of Fisheries and Aquatic Sciences 43(1):43-52. erall Duration: > 21 days; Exposure Duration: > 21 days								
				abamical of interact in averaging water but unable to determine event untely route)						
Exposure Route,	Aquatic (fre	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)								
Media, Path:	T	Mallasha Carbinda ar Adalt								
Faxa, Species, Age:		; Mollusks; <i>Corbicula sp.</i> ; Adult								
Health Outcome:	Developmen									
Chemical:	•	erpentine) (CASRN 12001-29-5)								
HERO ID:	3093600									
Domain		Metric	Rating	Comments						
Domain 1: Test Substan	ce									
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.						
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.						
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.						
Domain 2: Test Design	Metric 4:	Nagativa Controla	Iliah							
		Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.						
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.						
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.						
	, . <i>.</i> .									
Domain 3: Exposure Ch		Europin antal System / Tast Madia	High							
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.						
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.						
	Mettic 8.	Administration	Ingn	Exposures were administered consistently across study groups.						
	Metric 9:	Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.						
		Concentration								
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.						
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.						
Domain 4: Test Organis										
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.						
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.						
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.						
		Replicates per Group								
Domain 5: Outcome As		Replicates per Group		To bological represes were reported, but the experiment was repeated 5 times.						

Continued on next page ...

Study Citation:	Belanger, S.	E., Cherry, D. S., J. Cairns, J. R. (1986)	. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadiar			
Staaj Chundhi	•	Journal of Fisheries and Aquatic Sciences 43(1):43-52.					
Duration:		ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Invertebrate;	Mollusks; Corbicula sp.; Adult					
Health Outcome:	Developmen	t/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093600						
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	/ Variable Cor	ntrol					
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
		Design and Procedures					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Presenta	ation and Anal	Nois					
Domain 7. Data i resenta	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
	1.10010 23.	Explanation of Chexpected Outcomes	111511	chexpected outcomes were saustactority explained.			
Additional Comments:	This portion	of the study assessed shell size and tissue v	vater.				
Overall Qualit	v Detern	nination	High				

Study Citation:		E., Cherry, D. S., J, Cairns, , J. R. (1986) isheries and Aquatic Sciences 43(1):43-52		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian					
Duration:		ation: > 21 days; Exposure Duration: > 2							
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:									
Taxa, Species, Age:		nvertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult							
Health Outcome: Chemical:	Respiratory	erpentine) (CASRN 12001-29-5)							
HERO ID:	3093600	(CASKIV 12001-29-3)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	ce								
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
U	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	aracterization								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.					
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	inued on nex	xt page					

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		contir	nued from p	previous page			
Study Citation:			. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian			
		Journal of Fisheries and Aquatic Sciences 43(1):43-52.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:						
Taxa, Species, Age:	Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult						
Health Outcome:	Respiratory						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093600						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	g / Variable Cor	ntrol					
L. L	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
		Design and Procedures	U				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	veic					
Domain 7. Data Present	Metric 21:	Statistical Methods	N/A	Statistical analysis was performed and adequately described.			
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not shown for each treatment and control group,			
				but results were described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	This portion	of the study assessed locule area and comp	osition.				
Overall Qualit	ty Deterr	nination	High				
Overall Qualit	ty Detern	nination	High				

Study Citation:				chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian					
Duration:		isheries and Aquatic Sciences 43(1):43-52 ation: > 21 days; Exposure Duration: > 2							
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:		Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult ADME (biotransformation)							
Taxa, Species, Age:									
Health Outcome: Chemical:		transformation) erpentine) (CASRN 12001-29-5)							
HERO ID:	3093600	erpentine) (CASKIV 12001-29-5)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Cl	naracterization								
Domain 9. Exposure of	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	sm								
in rest organic	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.					
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.					
		Replicates per Group							
Domain 5: Outcome As									
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	inued on nex	t page					

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	continued from previous page					
Study Citation:	-	-	. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian		
Duration:		Journal of Fisheries and Aquatic Sciences 43(1):43-52. Overall Duration: > 21 days; Exposure Duration: > 21 days				
Exposure Route,			-	chamical of interact in exposure water, but upphle to determine exact uptake route)		
Media, Path:	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age:	Invertebrate; Mollusks; Corbicula sp.; Adult					
Health Outcome:	ADME (biotransformation)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	y / Variable Co	ntrol				
Domain of Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures	8			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	veic				
Domain 7. Data Hesent	Metric 21:	Statistical Methods	N/A	Statistical methods are typically not used for accumulation assessments.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not presented for each treatment, just the two high concs and the control.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
			-			
Additional Comments:	This portion	of the study assessed accumulation in the v	vhole body,	gills, and viscera. BCFs were also calculated.		
Overall Qualit	ty Deterr	nination	High			

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Asbestos

Study Citation:	Journal of F	isheries and Aquatic Sciences 43(1):43-52		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian
Duration: Exposure Route,		ation: > 21 days; Exposure Duration: > 2 shwater); Water; Not determined by study		chemical of interest in exposure water, but unable to determine exact uptake route)
Media, Path: Taxa, Species, Age:	Invertebrate	Mollusks; Corbicula sp.; Adult		
Health Outcome:		nnective Tissue		
Chemical: HERO ID:	chrysotile (s 3093600	erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain D. Exposure on	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
2 chiani ii rest organis	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
		Replicates per Group		
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Cont	tinued on nex	xt page

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Study Citation:	Belanger, S. E., Cherry, D. S., J, Cairns, , J. R. (1986). Uptake of chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian						
		Journal of Fisheries and Aquatic Sciences 43(1):43-52.					
Duration:		tion: > 21 days; Exposure Duration: > 21	days				
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:	1						
Taxa, Species, Age:	Invertebrate; Mollusks; Corbicula sp.; Adult						
Health Outcome:	Skin and Connective Tissue						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3093600						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	y / Variable Cou	ntrol					
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.			
		Design and Procedures	0				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present							
	Metric 21:	Statistical Methods	N/A	Statistical methods are typically not used for accumulation assessments.			
	Metric 22:	Reporting of Data	Low	Weight gain was reported as tissue water.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Qualit		•	High				

Study Citation:		E., Cherry, D. S., J, Cairns, , J. R. (1986) isheries and Aquatic Sciences 43(1):43-52		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian					
Duration:		ation: > 21 days; Exposure Duration: > 2							
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:	T . 1 .	Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult Behavioral							
Taxa, Species, Age: Health Outcome:									
Chemical:		erpentine) (CASRN 12001-29-5)							
HERO ID:	3093600	erpentine) (ertold (12001-2) 5)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
<u></u> <u>-</u> <u>B</u>	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported and reasonable for					
			T	reported outcomes; survival outcomes were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	naracterization								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance Concentration	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	sm								
0	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.					
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	tinued on nex	t page					

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Study Citation:				chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadiar		
		isheries and Aquatic Sciences $43(1):43-52$.				
Duration:		ation: > 21 days; Exposure Duration: > 21	-			
Exposure Route,	Aquatic (free	shwater); Water; Not determined by study a	uthors (1.e.,	chemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:		Mollusks; Corbicula sp.; Adult				
Health Outcome:	Behavioral					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain & Confounding	Variable Co	ntrol				
Domain 6: Confounding	-		II: -h			
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Design and Procedures	II: -h			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
		L L		A V A		
Additional Comments:	This portion	of the study assessed siphoning behavior.				
0 110 11		•				
Overall Qualit	ty Detern	nination	High			

Asbestos

Study Citation:		E., Cherry, D. S., J, Cairns, , J. R. (1986) isheries and Aquatic Sciences 43(1):43-52		chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian					
Duration:		ation: > 21 days; Exposure Duration: > 2							
Exposure Route,				chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:									
Taxa, Species, Age:		Invertebrate; Mollusks; <i>Corbicula sp.</i> ; Adult Skin and Connective Tissue							
Health Outcome: Chemical:		erpentine) (CASRN 12001-29-5)							
HERO ID:	3093600	(CASKIN 12001-29-3)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	nce								
	Metric 1:	Test Substance Identity	Medium	The test substance was identified, and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically characterized and verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
0	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was reported and reasonable for reported outcomes; survival outcomes were not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	haracterization								
2 onian of 2npoone of	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance	Medium	Exposure concentrations were not measured, but stock preps were analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response by the study author.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	sm								
i i i i i i i i i i i i i i i i i i i	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.					
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions for 14 days.					
	Metric 15:	Conditions Number of Organisms and	Medium	No biological replicates were reported, but the experiment was repeated 5 times.					
		Replicates per Group							
Domain 5: Outcome As	ssessment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	inued on nex	t page					

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		contir	nued from p	previous page		
Study Citation:	Belanger, S.	E., Cherry, D. S., J, Cairns, , J. R. (1986)	. Uptake of	chrysotile asbestos fibers alters growth and reproduction of Asiatic clams. Canadian		
		sheries and Aquatic Sciences 43(1):43-52.				
Duration:		ation: > 21 days; Exposure Duration: > 21	-			
Exposure Route,	Aquatic (freshwater); Water; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:		Mollusks; Corbicula sp.; Adult				
Health Outcome:	Skin and Connective Tissue					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3093600					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding	g / Variable Cor	ntrol				
L. L	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
		Design and Procedures	U			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	voie				
Domain 7. Data Present	Metric 21:	Statistical Methods	N/A	Adult mortality was reported as not significant in text.		
	Metric 22:	Reporting of Data	Low	Data for exposure-related findings were not shown for each treatment and control group,		
	Wieure 22.	Reporting of Data	LOW	but results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					
Overall Qualit	ty Detern	nination	High			

Study Citation:				2004). Environmental contamination of chrysotile asbestos and its toxic effects or				
				Archives of Environmental Contamination and Toxicology 47(3):281-289.				
Duration:		ation: > 21 days; Exposure Duration: > 21						
Exposure Route,			on), Not determi	ned by study authors (i.e., chemical of interest in exposure water, but unable t				
Media, Path:		xact uptake route) Magaular Planta, <i>Laura</i> g <i>ibba</i> , Nat Amplical						
Taxa, Species, Age: Health Outcome:		Vegetation; Vascular Plants; <i>Lemna gibba</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Development/Growth						
Chemical:	1	erpentine) (CASRN 12001-29-5)						
HERO ID:	3080106	erpentine) (CASKIV 12001-29-5)						
	5000100							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce Metric 1:	Toot Substance Identity	Low	The shaming was identified by some only				
	Metric 1:	Test Substance Identity Test Substance Source	Low Low	The chemical was identified by name only. The test substance identity was not analytically verified by the performing laboratory.				
	Metric 2: Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.				
	meute 3.	Test Substance I unity	LUW	The purity and/or grade of the test substance were not reported.				
Domain 2: Test Design								
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.				
	Metric 8:	Consistency of Exposure Administration	Medium	Details of exposure administration were reported, and exposures were administered consistently across study groups. It wasn't clear if the control fronds had clean water applied to the fronds.				
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured or measurements were not reported.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/	Medium	Only two concentrations were tested.				
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	An insoluble chemical was tested.				
Domain 4: Test Organis	m							
Gara	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a third generation field population.				
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.				
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	20 plants and three replicates seemed adequate.				

Domain 5: Outcome Assessment

Continued on next page ...

		conti	nued from previo	us page		
Study Citation:				004). Environmental contamination of chrysotile asbestos and its toxic effects or rchives of Environmental Contamination and Toxicology 47(3):281-289.		
Duration:		ation: > 21 days; Exposure Duration: > 21		Tenives of Environmental Containination and Toxicology 47(5):281-289.		
Exposure Route,			•	ed by study authors (i.e., chemical of interest in exposure water, but unable to		
Media, Path:	· ·	act uptake route)	,, 1 (00 000011111			
Taxa, Species, Age:		Vascular Plants; <i>Lemna gibba</i> ; Not Applica	ble (e.g., fungi or	algae studies) or Not Reported		
Health Outcome:	Development/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3080106					
Domain		Metric	Rating	Comments		
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology cited methods for determining attributes.		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for outcome assessment were lim-		
		Assessment		ited.		
Domain 6: Confounding	/ Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition.		
Domain 7: Data Presenta	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	None					
Overall Qualit	v Detern	nination	Medium			

Environmental Hazard Evaluation

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Study Citation:	Trivedi, A. K., Ahmad, I., Musthapa, M. S., Ansari, F. A., Rahman, Q. (2004). Environmental contamination of chrysotile asbestos and its toxic effects on growth and physiological and biochemical parameters of Lemna gibba. Archives of Environmental Contamination and Toxicology 47(3):281-289.					
Duration:		ation: > 21 days; Exposure Duration: > 21		Tenres of Environmental Containington and Toxicology (7(3).201 20).		
Exposure Route,	Aquatic (fre	shwater); Water; Dermal (topical application	on), Not determi	ned by study authors (i.e., chemical of interest in exposure water, but unable to		
Media, Path:	determine exact uptake route) Vegetation; Vascular Plants; <i>Lemna gibba</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Mechanistic-Biomarkers (exposure and effect)-Oxidative stress (including redox biology)-Photosynthesis chrysotile (serpentine) (CASRN 12001-29-5) 3080106					
Taxa, Species, Age:						
Health Outcome:						
Chemical:						
HERO ID:	3080106					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand						
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.		
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.		
Domain 2: Test Design						
2 1000 2 001gh	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for		
		roganite connorresponse		assessed outcomes.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
D						
Domain 3: Exposure Ch		Europimantal System/Test Madia	High			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure	Medium	Details of exposure administration were reported, and exposures were administered		
		Administration		consistently across study groups. It wasn't clear if the control fronds had clean water applied to the fronds.		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured or measurements were not reported.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/	Medium	Only two concentrations were tested.		
		Spacing of Exposure Levels				
	Metric 12:	Testing at or Below Solubility Limit	N/A	An insoluble chemical was tested.		
Domain 4: Test Organisi	m					
organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a third generation field population.		
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Conditions Number of Organisms and	Medium	20 plants and three replicates seemed adactists		
	Metric 15:	Replicates per Group	Medium	20 plants and three replicates seemed adequate.		
		Replicates per Group				
Domain 5: Outcome Ass	sessment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
		Conti	inued on next pa			

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		contin	ued from previ	ous page		
Study Citation:	Trivedi, A. K., Ahmad, I., Musthapa, M. S., Ansari, F. A., Rahman, Q. (2004). Environmental contamination of chrysotile asbestos and its toxic effects on growth and physiological and biochemical parameters of Lemna gibba. Archives of Environmental Contamination and Toxicology 47(3):281-289.					
Duration:		ation: > 21 days; Exposure Duration: > 21				
Exposure Route,				ned by study authors (i.e., chemical of interest in exposure water, but unable t		
Media, Path:	determine exact uptake route)					
Taxa, Species, Age:	Vegetation; Vascular Plants; Lemna gibba; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Mechanistic-Biomarkers (exposure and effect)-Oxidative stress (including redox biology)-Photosynthesis					
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)				
HERO ID:	3080106					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology cited methods for determining attributes.		
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for outcome assessment were lim		
		Assessment		ited.		
Domain 6: Confoundin	g / Variable Cor	ntrol				
	Metric 19:	Confounding Variables in Test	Low			
		e		conditions.		
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium			
Domain 7: Data Preser	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure		There was no information in the study to suggest differences among groups in animal		
Domain 7: Data Presen	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure		conditions. There was no information in the study to suggest differences among groups in animal		
Domain 7: Data Preser	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure ysis	Medium	conditions. There was no information in the study to suggest differences among groups in animal attrition. Statistical methods were adequately described.		
Domain 7: Data Preser	Metric 20: Itation and Analy Metric 21:	Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	Medium	conditions. There was no information in the study to suggest differences among groups in animal attrition.		

Overall Quality Determination

Medium

Study Citation:	Saxena, K. C., Srivastava, L., Dogra, R. K. (1982). Biochemical and histopathological response to chrysotile ingestion in guinea pigs. Industrial Health					
Duration:	20(1):19-25. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)					
		· · · ·	II. 0 - 4 uays (0-9	01)		
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:						
Taxa, Species, Age:		Mammalian; Cavia porcellus; Adult				
Health Outcome:		-Biomarkers (exposure and effect)-Gastroin	testinal			
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	1797399					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.		
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.		
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.		
Domain 2: Test Design						
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	Medium	The biological responses of the negative control group were reported, but there was no comment on control condition other than specific responses.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Ch	aracterization					
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.		
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The exposure duration was suitable for these endpoints.		
	Metric 11:	Number of Exposure Groups/	N/A	A timed dose response was the goal, so only one exposure group was used.		
	Methe 11.	Spacing of Exposure Levels	1N/A	A timed dose response was the goal, so only one exposure group was used.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.		
Domain 4. Test Organia						
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the scientific name was not provided They were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions, and all pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Number of Organisms and	Low	It was reported there were 60 animals per treatment, but no replicates were used.		
		Replicates per Group				
Domain 5: Outcome Ass	sessment					
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
		Conti	nued on next pa			
		Contr	on near pe			

Saxena, K. C., Srivastava, L., Dogra, R. K. (1982). Biochemical and histopathological response to chrysotile ingestion in guinea pigs. Industrial Health 20(1):19-25					
		: 0 - 4 days (0-9	6h)		
,					
Vertebrate; N	Mammalian; Cavia porcellus; Adult				
Mechanistic-Biomarkers (exposure and effect)-Gastrointestinal					
chrysotile (serpentine) (CASRN 12001-29-5)					
1797399					
	Metric	Rating	Comments		
Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcomes of interest.		
Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
/ Variable Co					
Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.		
ation and Anal	vsis				
Metric 21:	Statistical Methods	High	Statistical analysis was performed and described adequately.		
Metric 22:		-	Data for exposure-related findings were presented for each treatment and control group		
Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
None					
	20(1):19-25. Overall Dura Terrestrial; F Vertebrate; M Mechanistic- chrysotile (sr 1797399 Metric 17: Metric 18: / Variable Con Metric 19: Metric 20: ation and Anal Metric 21: Metric 22: Metric 23:	20(1):19-25. Overall Duration: 0 - 4 days (0-96h); Exposure Duration Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Cavia porcellus</i> ; Adult Mechanistic-Biomarkers (exposure and effect)-Gastroint chrysotile (serpentine) (CASRN 12001-29-5) 1797399 <u>Metric</u> Metric 17: Outcome Assessment Methodology Metric 18: Consistency of Outcome Assessment / Variable Control Metric 19: Confounding Variables in Test Design and Procedures Metric 20: Outcomes Unrelated to Exposure ation and Analysis Metric 21: Statistical Methods Metric 22: Reporting of Data Metric 23: Explanation of Unexpected Outcomes	20(1):19-25. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-9 Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; Cavia porcellus; Adult Mechanistic-Biomarkers (exposure and effect)-Gastrointestinal chrysotile (serpentine) (CASRN 12001-29-5) 1797399 Metric Rating Metric 17: Outcome Assessment Methodology High Assessment / Variable Control Metric 19: Confounding Variables in Test Low Design and Procedures Metric 20: Outcomes Unrelated to Exposure Metric 21: Statistical Methods Metric 22: Reporting of Data Metric 23: Explanation of Unexpected Outcomes		

Asbestos

Study Citation:	20(1):19-25			stopathological response to chrysotile ingestion in guinea pigs. Industrial Health					
Duration: Exposure Route, Media, Path:		ation: 0 - 4 days (0-96h); Exposure Duration Food/Diet; Dietary	n: 0 - 4 days (0-9	6h)					
Taxa, Species, Age: Health Outcome:		Vertebrate; Mammalian; <i>Cavia porcellus</i> ; Adult							
Chemical:		Gastrointestinal chrysotile (serpentine) (CASRN 12001-29-5)							
HERO ID:	1797399	•							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan			_						
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Medium	The biological responses of the negative control group were reported, but there was no comment on control condition other than specific responses.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
D (2) E Ch									
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Uiah	The eventimental quatern and methods for momentian of the test media years described					
	Metric 7.	Preparation	High	The experimental system and methods for preparation of the test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
		Administration	6	1					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The exposure duration was suitable for these endpoints.					
	Metric 11:	Number of Exposure Groups/	N/A	A timed dose response was the goal, so only one exposure group was used.					
		Spacing of Exposure Levels							
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the scientific name was not provided They were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions, and all pretreatment conditions were the same for control and exposed organisms.					
	Metric 15:	Number of Organisms and	Low	It was reported there were 60 animals per treatment, but no replicates were used.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcomes of interest.					
		Conti	nued on next pa	πο					

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Study Citation:	Saxena, K. C., Srivastava, L., Dogra, R. K. (1982). Biochemical and histopathological response to chrysotile ingestion in guinea pigs. Industrial Health 20(1):19-25.					
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration:	0 - 4 days (0 - 9)	6h)		
Exposure Route,		Food/Diet; Dietary	0 1 dujs (0)			
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Cavia porcellus; Adult				
Health Outcome:	Gastrointestinal					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	1797399					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
	methe 10.		8	, , , , , , , , , , , , , , , , , , ,		
	incure 10.	Assessment	6			
Domain 6: Confounding		Assessment	6			
Domain 6: Confounding		Assessment ntrol Confounding Variables in Test	Low			
Domain 6: Confounding	g / Variable Co	Assessment		The study did not provide enough information to allow a comparison of environmental		
	g / Variable Con Metric 19: Metric 20:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	g / Variable Con Metric 19: Metric 20: ation and Anal	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	Low High	The study did not provide enough information to allow a comparison of environmental conditions. There were no differences among groups.		
Domain 6: Confounding Domain 7: Data Present	g / Variable Con Metric 19: Metric 20: ation and Anal Metric 21:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	Low High High	The study did not provide enough information to allow a comparison of environmental conditions. There were no differences among groups. Statistical analysis was performed and described adequately.		
	g / Variable Con Metric 19: Metric 20: ation and Anal Metric 21: Metric 22:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods Reporting of Data	Low High High High	The study did not provide enough information to allow a comparison of environmental conditions. There were no differences among groups. Statistical analysis was performed and described adequately. Data for exposure-related findings were presented for each treatment and control group		
	g / Variable Con Metric 19: Metric 20: ation and Anal Metric 21:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	Low High High	The study did not provide enough information to allow a comparison of environmental conditions. There were no differences among groups. Statistical analysis was performed and described adequately.		

Study Citation:	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of				
-	nickel. Envi	ronmental Research 12(2):139-143.			
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	n: 0 - 4 days (0-9	(6h)	
Exposure Route,	Terrestrial; 1	Food/Diet; Dietary			
Media, Path:					
Taxa, Species, Age:		Mammalian; <i>Cavia porcellus</i> ; Not Applicabl	le (e.g., fungi or	algae studies) or Not Reported	
Health Outcome:	Gastrointest				
Chemical:	•	erpentine) (CASRN 12001-29-5)			
HERO ID:	1060372				
Domain		Metric	Rating	Comments	
Domain 1: Test Substan					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.	
	Metric 2:	Test Substance Source	Low	The source was not reported.	
	Metric 3:	Test Substance Purity	Low	The purity and grade of the test substance were not reported.	
Domain 2: Test Design					
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.	
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.	
Domain 3: Exposure Ch					
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.	
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.	
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.	
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure was reported and suitable for the study type.	
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.	
		Spacing of Exposure Levels			
	Metric 12:	Testing at or Below Solubility Limit	N/A	The exposure was via gavage.	
Domain 4: Test Organis	m				
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.	
	Metric 13: Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized, but they were faste	
	Meule 14.	Conditions	wiedium	The study and not report whether test organisms were acclimatized, but lify were laste	
	Metric 15:	Number of Organisms and	Medium	The number of test organisms (20) was reported and sufficient for the purpose of this	
		Replicates per Group		study.	
Domain 5: Outcome As	sessment				
2 smain 5. Outcome Ab	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade-	
			2011	quate.	
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.	
		~ · ·	nued on next pa		

		····contin	ued from previ	ous page			
Study Citation:	Zaidi, S. H.,	Gupta, G. S., Rahman, Q., Kaw, J. L., Shan	nker, R. (1976).	Early response of gastric mucosa to ingested asbestos dust and the dissolution o			
		nickel. Environmental Research 12(2):139-143.					
Duration:	Overall Dura	ation: 0 - 4 days (0-96h); Exposure Duration	: 0 - 4 days (0-9	6h)			
Exposure Route,	Terrestrial; I	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Cavia porcellus; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:	Gastrointestinal						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	1060372						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
	Metric 20.	outcomes officiated to Exposure	Wiedrum	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.			
Additional Comments:	This portion	of the study assessed gastric inice characteri	istics post appo	1152			
Additional Comments:	This portion	of the study assessed gastric juice characteri	istics post expos	แต่.			
	Doto	mination	Madin				
Overall Quali	ly Detern	mation	Medium				

	Conti	nued on next pa	σe				
	Assessment						
Metric 17: Metric 18:	Outcome Assessment Methodology Consistency of Outcome	High High	The outcome assessment methodology reported the intended outcome of interest. Outcomes were assessed consistently across study groups.				
ssessment Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.				
Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The number of test organisms (20) was reported and sufficient for the purpose of this study.				
Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized, but they were faste				
Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.				
sm							
Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	The exposure was via gavage.				
Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.				
Metric 10:	Concentration		The duration of the exposure was reported and suitable for the study type.				
	Administration	C C	Exposures were administered consistently across study groups. Exposure concentrations were not measured.				
	Preparation		test concentrations.				
	Experimental System/Test Media	Low	The study provided only limited details on the measures taken to appropriately prepare				
Metric 6:	Kandomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
		-	The biological response of the negative control group was reported and reasonable for assessed outcomes.				
Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
Metric 3:	Test Substance Purity	Low	The purity and grade of the test substance were not reported.				
Metric 2:	Test Substance Source	Low	The source was not reported.				
nce Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric	Rating	Comments				
1060372							
,		ie (e.g., fungi or	algae studies) or Not Reported				
T 7 , 1 , T							
		n: 0 - 4 davs (0-9	6h)				
Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel Environmental Pasaarch 12(2):130-143							
	nickel. Envi Overall Dura Terrestrial; H Gastrointest tremolite (C 1060372 nce Metric 1: Metric 2: Metric 2: Metric 3: Metric 5: Metric 5: Metric 6: haracterization Metric 7: Metric 8: Metric 8: Metric 10: Metric 10: Metric 12: sm Metric 13: Metric 14: Metric 15: ssessment Metric 16:	nickel. Environmental Research 12(2):139-143. Overall Duration: 0 - 4 days (0-96h); Exposure Duration Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Cavia porcellus</i> ; Not Applicab Gastrointestinal tremolite (CASRN 14567-73-8) 1060372 Metric Metric 1: Test Substance Identity Metric 2: Test Substance Source Metric 3: Test Substance Purity Metric 3: Test Substance Purity Metric 5: Negative Controls Metric 6: Randomized Allocation Metric 7: Experimental System/Test Media Preparation Metric 8: Consistency of Exposure Administration Metric 9: Measurement of Test Substance Concentration Metric 10: Exposure Duration and Frequency Metric 11: Number of Exposure Groups/ Spacing of Exposure Levels Metric 12: Testing at or Below Solubility Limit sm Metric 13: Test Organism Characteristics Metric 14: Acclimatization and Pretreatment Conditions Metric 15: Number of Organisms and Replicates per Group ssessment Metric 16: Adequacy of Test Conditions Metric 17: Outcome Assessment Methodology Metric 18: Consistency of Outcome Assessment	nickel. Environmental Research 12(2):139-143. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-9 Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Cavia porcellus</i> ; Not Applicable (e.g., fungi or Gastrointestinal tremolite (CASRN 14567-73-8) 1060372 Metric Rating nce Metric 1: Test Substance Identity Low Metric 2: Test Substance Source Low Metric 3: Test Substance Purity Low Metric 5: Negative Controls High Metric 6: Randomized Allocation Low haracterization Metric 7: Experimental System/Test Media Low Preparation Metric 8: Consistency of Exposure High Metric 9: Measurement of Test Substance Low Metric 10: Exposure Duration and Frequency High Metric 11: Number of Exposure Levels Metric 12: Test Organism Characteristics Medium Metric 13: Test Organism Characteristics Medium Metric 14: Acclimatization and Pretreatment Medium Conditions Metric 15: Number of Organisms and Metric 16: Adequacy of Test Conditions Low Metric 17: Outcome Assessment Methodology High Metric 17: Outcome Assessment Methodology High Metric 17: Outcome Assessment Methodology High Metric 18: Consistency of Outcome High Metric 18: Consistency of Outcome High				

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Study Citation:		-	nker, R. (1976).	Early response of gastric mucosa to ingested asbestos dust and the dissolution of	
T		ronmental Research 12(2):139-143.			
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	n: 0 - 4 days (0-9	6h)	
Exposure Route,	Terrestrial; I	Food/Diet; Dietary			
Media, Path:					
Taxa, Species, Age:	Vertebrate; Mammalian; Cavia porcellus; Not Applicable (e.g., fungi or algae studies) or Not Reported				
Health Outcome:	Gastrointestinal				
Chemical:	tremolite (CASRN 14567-73-8)				
HERO ID:	1060372				
Domain		Metric	Rating	Comments	
Domain 6: Confounding	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	Low Medium	The study did not provide enough information to allow a comparison of environmental conditions. There was no information in the study to suggest differences among groups.	
	Metric 20.		mean	There was no mornadon in the study to suggest differences allong groups.	
Domain 7: Data Present	ation and Anal	lysis			
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.	
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.	
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.	
Additional Comments:	This portion	of the study assessed gastric juice character	istics post expos	ure.	
Overall Quali	ty Deterr	nination	Medium		

Study Citation: Duration: Exposure Route, Media, Path:	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel. Environmental Research 12(2):139-143. Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h) Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age: Health Outcome: Chemical:	Gastrointest	Mammalian; <i>Cavia porcellus</i> ; Not Applicab inal e (CASRN 17068-78-9)	le (e.g., fungi or	algae studies) or Not Reported		
HERO ID:	1060372					
Domain		Metric	Rating	Comments		
Domain 1: Test Substance	ce					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.		
	Metric 2:	Test Substance Source	Low	The source was not reported.		
	Metric 3:	Test Substance Purity	Low	The purity and grade of the test substance were not reported.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 2. Europouro Chi	anatonization					
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.		
	Metric 8:	Preparation Consistency of Exposure	High	Exposures were administered consistently across study groups.		
	Wietrie 0.	Administration	Ingn	Exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure was reported and suitable for the study type.		
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.		
	Matria 12.	Spacing of Exposure Levels Testing at or Below Solubility Limit	NT/A	m.		
	Metric 12:	resulig at or below solubility Liffle	N/A	The exposure was via gavage.		
Domain 4: Test Organisr	n					
-	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.		
	Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized, but they were faster		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The number of test organisms (20) was reported and sufficient for the purpose of this study.		
		Trephenies per Group		•		
Domain 5: Outcome Ass	sessment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.		
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.		

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Study Citation:	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel. Environmental Research 12(2):139-143.					
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration	: 0 - 4 days (0-9	6h)		
Exposure Route,	Terrestrial; I	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Cavia porcellus; Not Applicable	e (e.g., fungi or	algae studies) or Not Reported		
Health Outcome:	Gastrointest	inal				
Chemical:	anthophyllit	e (CASRN 17068-78-9)				
HERO ID:	1060372					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Co Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	lysis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This portion	of the study assessed gastric juice character	istics post expos	ure.		
Overall Quali	ty Deterr	nination	Medium			

Study Citation:	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel. Environmental Research 12(2):139-143.
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Cavia porcellus; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	1060372

Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	Low	The source was not reported.
	Metric 3:	Test Substance Purity	Low	The purity and grade of the test substance were not reported.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for the assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	The exposure was via gavage.
Domain 4: Test Organis	m			
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.
	Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized, but they were fasted.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The number of test organisms (20) was reported and sufficient for the purpose of this study.
Domain 5: Outcome As	sessment			
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were ade- quate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
			nued on next pa	ge

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Study Citation:	Zaidi, S. H., Gupta, G. S., Rahman, Q., Kaw, J. L., Shanker, R. (1976). Early response of gastric mucosa to ingested asbestos dust and the dissolution of nickel. Environmental Research 12(2):139-143.					
Duration:	Overall Dura	ation: 0 - 4 days (0-96h); Exposure Duration	n: 0 - 4 days (0-9	6h)		
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Cavia porcellus; Not Applicable	e (e.g., fungi or	algae studies) or Not Reported		
Health Outcome:	Gastrointest	inal				
Chemical:	amosite (gru	nerite) (CASRN 12172-73-5)				
HERO ID:	1060372					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This portion	of the study assessed gastric juice character	istics post expos	ure.		
Overall Quali	ty Detern	nination	Medium			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	R., Peacock, A. (1965). Asbestos-induced t ation: > 21 days; Exposure Duration: 0 - 4 N/A (e.g., injection); Injection		ite leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Cancer/Carc			dult 001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only. The study authors reported "0.5 ml. "asbestos" (of unknown origin) suspension in tributyrin"
	Metric 2:	Test Substance Source	Low	The source of the asbestos was not reported. It was also not reported whether the as- bestos was analytically verfied.
	Metric 3:	Test Substance Purity	Low	The size and distribution of the asbestos was not reported.
Domain 2: Test Design	Metric 4:	Negative Controls	Low	It was not reported that a concurrent negative control was used for the study. However, the study authors reported that all other fowl grown in their line-bred fowl could be used as negative controls.
	Metric 5:	Negative Control Response	Low	It was reported that all line-bred white leghorn fowl grown by the researchers had never experienced spontaneous lung tumors. This was reported in the text and was suggested to be the negative control.
	Metric 6:	Randomized Allocation	Low	The researchers did not report how the fowl were allocated into study groups.
Demain 2: English Ch				
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Low	The study provided limited details on the preparation of the test substance and on the
	1.10010 /.	Preparation	Low	test system. Finely ground asbestos powders were suspended in tributyrin.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. All birds were injected with asbestos/tributyrin suspension in the right axillary air sac.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the exposure concentrations were measured or if analysis had been done on the asbestos fibers' concentration, size, and distribution.
	Metric 10:	Exposure Duration and Frequency	High	This appears to be a lifelong study that is ongoing at the point that this paper was writ- ten. Exposure was via the one injection.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The purpose of the study was not to have a dose response, but to observe the pathologi- cal effects of asbestos injected into the air sacs of white leghorn fowl.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.
Domain 4: Test Organisr	n			
	Metric 13:	Test Organism Characteristics	Low	The scientific name of the test organisms was not given. It was not reported what the fowl were fed or how often they were fed. The source was not reported, but it was implied they were obtained from the laboratory performing the study.
		Conti	inued on ne	xt page

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	continued from previous page				
Study Citation:	Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.				
Duration:	Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h)				
Exposure Route,	Terrestrial; N/A (e.g., injection); Injection				
Media, Path:					
Taxa, Species, Age:	Vertebrate; Avian; Gallus gallus domesticus; White leghorn fowl; Adult				
Health Outcome:	Cancer/Carcinogenesis				
Chemical:	asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)				
HERO ID:	3664651				

Domain		Metric	Rating	Comments
Domani	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported whether the fowl were acclimatized to test conditions.
		Conditions	2011	
	Metric 15:	Number of Organisms and	Low	In the first test, 6 birds were injected with asbestos. In the second test, 12 birds were
		Replicates per Group		injected with amosite and 12 birds were injected with crocidolite. This is a low quantity of organisms for a study.
Domain 5: Outcome As	ssessment			
	Metric 16:	Adequacy of Test Conditions	Low	The housing and environmental conditions were not sufficiently reported to evaluate if they were adequate. The study did not report the feeding and watering regimen of the fowl either.
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported. There was no infor- mation on how often the health of the fowl was observed or when a bird may have been euthanized for examination/necropsy.
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited or not reported at all. There was not information provided as to when a fowl was euthanized for necropsy or how often fowl were observed for health/behavioral issues.
Domain 6: Confoundin	g / Variable Cou	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions—it was not reported whether the fowl were acclimatized to test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.
Domain 7: Data Presen	tation and Anal	vsis		
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not per- formed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a descrip- tion of a concurrent negative control. This paper appears to have been written as the study was ongoing, and thus there may have been more results reported after this paper was written.
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were minor uncertainties regarding how the study characterized unexpected out- comes. Little information on methods used and methods assessment prevents characteri- zation of unexpected outcomes.

		continued from previous page				
Study Citation: Duration:	Peacock, P. R., Peacock, A. (1965). Asbest Overall Duration: > 21 days; Exposure Du		vls. Annals of the New York Academy of Sciences 132(1):501-503.			
Exposure Route,	Terrestrial; N/A (e.g., injection); Injection					
Media, Path:						
Taxa, Species, Age:	Vertebrate; Avian; Gallus gallus domesticu	s; White leghorn fowl; Adult				
Health Outcome:	Cancer/Carcinogenesis					
Chemical:	asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amos	site (grunerite) (CASRN 12172-73-5)			
HERO ID:	3664651					
Domain	Metric	Rating	Comments			
Additional Comments:	This form is for Crocidolite. This paper v	was on the effects of undetermined asbe	estos fibers, amosite and crocidolite on white leghorn fowl after being			
	injected into the right axillary air sac. This	s study appears to be ongoing at the tim	he this paper was written, so there may have been more results reported			
	later. It is also possible this is the reason for the lack of detail in this paper. It is unclear how this paper can be used qualitatively given that the purpose					
	of the study was to observe the reaction of "mesothelial and pulmonary epithelial tissues of fowls to asbestos." This is a descriptive toxicity study. No					
	dose/response information was provided. A	Animals were sacrificed at different time	points, and observations regarding the response to asbestos were made.			

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Study Citation: Duration: Exposure Route, Media, Path:	Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503. Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h) Terrestrial; N/A (e.g., injection); Injection				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mortality	Avian; <i>Gallus gallus domesticus</i> ; White leg ASRN 1332-21-4)-crocidolite (riebeckite) (· · ·	udult 001-28-4)-amosite (grunerite) (CASRN 12172-73-5)	
Domain		Metric	Rating	Comments	
Domain 1: Test Substand					
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only. The study authors reported "0.5 ml. "asbestos" (of unknown origin) suspension in tributyrin"	
	Metric 2:	Test Substance Source	Low	The source of the asbestos was not reported. It was also not reported whether the as- bestos was analytically verfied.	
	Metric 3:	Test Substance Purity	Low	The size and distribution of the asbestos was not reported.	
Domain 2. Test Design					
Domain 2: Test Design	Metric 4:	Negative Controls	Low	It was not reported that a concurrent negative control was used for the study. However, the study authors reported that all other fowl grown in their line-bred fowl could be used as negative controls.	
	Metric 5:	Negative Control Response	Low	It was reported that all line-bred white leghorn fowl grown by the researchers had never experienced spontaneous lung tumors. This was reported in the text and was suggested to be the negative control.	
	Metric 6:	Randomized Allocation	Low	The researchers did not report how the fowl were allocated into study groups.	
Damain 2. Erra anna Ch					
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Low	The study provided limited details on the preparation of the test substance and on the	
	Metric 8:	Preparation Consistency of Exposure Administration	High	test system. Finely ground asbestos powders were suspended in tributyrin. Details of exposure administration were reported, and exposures were administered con- sistently across study groups. All birds were injected with asbestos/tributyrin suspension in the right axillary air sac.	
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the exposure concentrations were measured or if analysis had been done on the asbestos fibers' concentration, size, and distribution.	
	Metric 10:	Exposure Duration and Frequency	High	This appears to be a lifelong study that is ongoing at the point that this paper was writ- ten. Exposure was via the one injection.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The purpose of the study was not to have a dose response, but to observe the pathologi- cal effects of asbestos injected into the air sacs of white leghorn fowl.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.	
Domain 4: Test Organisr	m Metric 13:	Test Organism Characteristics	Low	The scientific name of the test organisms was not given. It was not reported what the fowl were fed or how often they were fed. The source was not reported, but it was implied they were obtained from the laboratory performing the study.	
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the fowl were acclimatized to test conditions.	
			inued on ne	xt nage	

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	R., Peacock, A. (1965). Asbestos-induced t ation: > 21 days; Exposure Duration: 0 - 4 V/A (e.g., injection); Injection		ite leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mortality	Avian; <i>Gallus gallus domesticus</i> ; White leg ASRN 1332-21-4)-crocidolite (riebeckite) (dult 01-28-4)-amosite (grunerite) (CASRN 12172-73-5)
Domain		Metric	Rating	Comments
	Metric 15:	Number of Organisms and Replicates per Group	Low	In the first test, 6 birds were injected with asbestos. In the second test, 12 birds were injected with amosite and 12 birds were injected with crocidolite. This is a low quantity of organisms for a study.
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	Low	The housing and environmental conditions were not sufficiently reported to evaluate if they were adequate. The study did not report the feeding and watering regimen of the fowl either.
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported. There was no infor- mation on how often the health of the fowl was observed or when a bird may have been euthanized for examination/necropsy.
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited or not reported at all. There was not information provided as to when a fowl was euthanized for necropsy or how often fowl were observed for health/behavioral issues.
Domain 6: Confoundir	og / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	conditions—it was not reported whether the fowl were acclimatized to test conditions. There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.
Demein 7. Dete Deser				
Domain 7: Data Preser	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not per- formed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a descrip- tion of a concurrent negative control. This paper appears to have been written as the study was ongoing, and thus there may have been more results reported after this paper was written.
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were minor uncertainties regarding how the study characterized unexpected out- comes. Little information on methods used and methods assessment prevents characteri- zation of unexpected outcomes.

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Study Citation: Duration: Exposure Route,	Peacock, P. R., Peacock, A. (1965). Asbesto Overall Duration: > 21 days; Exposure Dura Terrestrial; N/A (e.g., injection); Injection		owls. Annals of the New York Academy of Sciences 132(1):501-503.
Media, Path:	Terrestriar, TVT (e.g., injection), injection		
Taxa, Species, Age:	Vertebrate; Avian; Gallus gallus domesticus	; White leghorn fowl; Adult	
Health Outcome:	Mortality	-	
Chemical:	asbestos (CASRN 1332-21-4)-crocidolite (ri	iebeckite) (CASRN 12001-28-4)-am	nosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651		
Domain	Metric	Rating	Comments
Additional Comments:	of undetermined asbestos fibers, amosite an be ongoing at the time this paper was writt detail in this paper. It is unclear how this pa	nd crocidolite on white leghorn fowl ten, so there may have been more r aper can be used qualitatively given o asbestos." This is a descriptive to	ears; study duration 48 months; 1ml dose. This paper was on the effects a fater being injected into the right axillary air sac. This study appears to results reported later. It is also possible this is the reason for the lack of that the purpose of the study was to observe the reaction of "mesothelial axicity study. No dose/response information was provided. Animals were bestos were made.

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Atudy Citation:Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1)Ouration:Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h)Exposure Route,Terrestrial; N/A (e.g., injection); InjectionAtedia, Path:Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1)						
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticus</i> ; White leghorn fowl; Adult Mortality asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3664651					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand						
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only. The study authors reported "0.5 ml. "asbestos" (of unknown origin) suspension in tributyrin"		
	Metric 2:	Test Substance Source	Low	The source of the asbestos was not reported. It was also not reported whether the as- bestos was analytically verfied.		
	Metric 3:	Test Substance Purity	Low	The size and distribution of the asbestos was not reported.		
Domain 2. Test Design						
Domain 2: Test Design	Metric 4:	Negative Controls	Low	It was not reported that a concurrent negative control was used for the study. However, the study authors reported that all other fowl grown in their line-bred fowl could be used as negative controls.		
	Metric 5:	Negative Control Response	Low	It was reported that all line-bred white leghorn fowl grown by the researchers had never experienced spontaneous lung tumors. This was reported in the text and was suggested to be the negative control.		
	Metric 6:	Randomized Allocation	Low	The researchers did not report how the fowl were allocated into study groups.		
	, . ,.					
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Low	The study provided limited details on the preparation of the test substance and on the		
	Metric 8:	Preparation Consistency of Exposure Administration	High	test system. Finely ground asbestos powders were suspended in tributyrin. Details of exposure administration were reported, and exposures were administered con- sistently across study groups. All birds were injected with asbestos/tributyrin suspension in the right axillary air sac.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the exposure concentrations were measured or if analysis had been done on the asbestos fibers' concentration, size, and distribution.		
	Metric 10:	Exposure Duration and Frequency	High	This appears to be a lifelong study that is ongoing at the point that this paper was writ- ten. Exposure was via the one injection.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The purpose of the study was not to have a dose response, but to observe the pathologi- cal effects of asbestos injected into the air sacs of white leghorn fowl.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.		
Domain 4: Test Organis	m Metric 13:	Test Organism Characteristics	Low	The scientific name of the test organisms was not given. It was not reported what the		
	wieule 15:	rest Organism Characteristics	LUW	fowl were fed or how often they were fed. The source was not reported, but it was im- plied they were obtained from the laboratory performing the study.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the fowl were acclimatized to test conditions.		
			inued on ne	xt page		

Study Citation: Duration: Exposure Route, Media, Path:	 Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503. Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h) Terrestrial; N/A (e.g., injection); Injection Vertebrate; Avian; <i>Gallus gallus domesticus</i>; White leghorn fowl; Adult Mortality asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3664651 					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:						
Domain		Metric	Rating	Comments		
	Metric 15:	Number of Organisms and Replicates per Group	Low	In the first test, 6 birds were injected with asbestos. In the second test, 12 birds were injected with amosite and 12 birds were injected with crocidolite. This is a low quantity of organisms for a study.		
Domain 5: Outcome A	ssessment					
	Metric 16:	Adequacy of Test Conditions	Low	The housing and environmental conditions were not sufficiently reported to evaluate if they were adequate. The study did not report the feeding and watering regimen of the fowl either.		
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported. There was no infor- mation on how often the health of the fowl was observed or when a bird may have been euthanized for examination/necropsy.		
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited or not reported at all. There was not information provided as to when a fowl was euthanized for necropsy or how often fowl were observed for health/behavioral issues.		
Domain 6: Confoundin	og / Variable Co	ntrol				
Domain 0. Comoundai	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	conditions—it was not reported whether the fowl were acclimatized to test conditions. There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Demeia 7. Dete Dave						
Domain 7: Data Preser	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not per- formed.		
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a descrip- tion of a concurrent negative control. This paper appears to have been written as the study was ongoing, and thus there may have been more results reported after this paper was written.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were minor uncertainties regarding how the study characterized unexpected out- comes. Little information on methods used and methods assessment prevents characteri- zation of unexpected outcomes.		

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Study Citation: Duration:	Overall Duration: > 21 days; Exposure Duration	6	fowls. Annals of the New York Academy of Sciences 132(1):501-503.
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection		
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticus</i> Mortality asbestos (CASRN 1332-21-4)-crocidolite (r 3664651		nosite (grunerite) (CASRN 12172-73-5)
Domain	Metric	Rating	Comments
Additional Comments:	asbestos fibers, amosite and crocidolite on time this paper was written, so there may ha unclear how this paper can be used qualitat	, 3 Month(s); exposure and study du white leghorn fowl after being inject ave been more results reported later. ively given that the purpose of the s criptive toxicity study. No dose/resp	tration 48 months; 1ml dose. This paper was on the effects of undetermined cted into the right axillary air sac. This study appears to be ongoing at the It is also possible this is the reason for the lack of detail in this paper. It is study was to observe the reaction of "mesothelial and pulmonary epithelial ponse information was provided. Animals were sacrificed at different time

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Study Citation: Duration: Exposure Route, Media, Path:	Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503. Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h) Terrestrial; N/A (e.g., injection); Injection					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticus</i> ; White leghorn fowl; Adult Cancer/Carcinogenesis asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3664651					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	Low	The test substances were identified by name only. The study authors reported "0.5 ml.		
	metho I.	Test Bubbande Robinty	Low	"asbestos" (of unknown origin) suspension in tributyrin"		
	Metric 2:	Test Substance Source	Low	The source of the asbestos was not reported. It was also not reported whether the as- bestos was analytically verfied.		
	Metric 3:	Test Substance Purity	Low	The size and distribution of the asbestos was not reported.		
Domain 2: Test Design						
Domain 2. Test Design	Metric 4:	Negative Controls	Low	It was not reported that a concurrent negative control was used for the study. However, the study authors reported that all other fowl grown in their line-bred fowl could be used as negative controls.		
	Metric 5:	Negative Control Response	Low	It was reported that all line-bred white leghorn fowl grown by the researchers had never experienced spontaneous lung tumors. This was reported in the text and was suggested to be the negative control.		
	Metric 6:	Randomized Allocation	Low	The researchers did not report how the fowl were allocated into study groups.		
Domain 3: Exposure Cha	ornatarization					
Domain 5. Exposure Cha	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided limited details on the preparation of the test substance and on the test system. Finely ground asbestos powders were suspended in tributyrin.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. All birds were injected with asbestos/tributyrin suspension in the right axillary air sac.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the exposure concentrations were measured or if analysis had been done on the asbestos fibers' concentration, size, and distribution.		
	Metric 10:	Exposure Duration and Frequency	High	This appears to be a lifelong study that is ongoing at the point that this paper was writ- ten. Exposure was via the one injection.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The purpose of the study was not to have a dose response, but to observe the pathologi- cal effects of asbestos injected into the air sacs of white leghorn fowl.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.		
Domain 4. Toot Orrow						
Domain 4: Test Organisr	m Metric 13:	Test Organism Characteristics	Low	The scientific name of the test organisms was not given. It was not reported what the fowl were fed or how often they were fed. The source was not reported, but it was implied they were obtained from the laboratory performing the study.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the fowl were acclimatized to test conditions.		
			inued on ne	xt page		

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	tation: > 21 days; Exposure Duration: 0 - 4 V/A (e.g., injection); Injection		ite leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.		
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticus</i> ; White leghorn fowl; Adult Cancer/Carcinogenesis asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3664651					
Domain		Metric	Rating	Comments		
	Metric 15:	Number of Organisms and Replicates per Group	Low	In the first test, 6 birds were injected with asbestos. In the second test, 12 birds were injected with amosite and 12 birds were injected with crocidolite. This is a low quantity of organisms for a study.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Low	The housing and environmental conditions were not sufficiently reported to evaluate if they were adequate. The study did not report the feeding and watering regimen of the fowl either.		
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported. There was no infor- mation on how often the health of the fowl was observed or when a bird may have been euthanized for examination/necropsy.		
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited or not reported at all. There was not information provided as to when a fowl was euthanized for necropsy or how often fowl were observed for health/behavioral issues.		
Domain 6: Confounding	y / Variable Cou	ntrol				
2 onium of Comountainy	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-it was not reported whether the fowl were acclimatized to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not per- formed.		
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a descrip- tion of a concurrent negative control. This paper appears to have been written as the study was ongoing, and thus there may have been more results reported after this paper was written.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were minor uncertainties regarding how the study characterized unexpected out- comes. Little information on methods used and methods assessment prevents characteri- zation of unexpected outcomes.		

into the right axillary air sac. This study appears to be ongoing at the time this paper was written, so there may have been more results reported later. It is also possible this is the reason for the lack of detail in this paper. It is unclear how this paper can be used qualitatively given that the purpose of the study was to observe the reaction of "mesothelial and pulmonary epithelial tissues of fowls to asbestos." This is a descriptive toxicity study. No dose/response information was provided. Animals were sacrificed at different time points, and observations regarding the response to asbestos were made.

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Study Citation:			ls. Annals of the New York Academy of Sciences 132(1):501-503.
Duration:	Overall Duration: > 21 days; Exposure Duration:	ation: 0 - 4 days (0-96h)	
Exposure Route,	Terrestrial; N/A (e.g., injection); Injection		
Media, Path:			
Taxa, Species, Age:	Vertebrate; Avian; Gallus gallus domesticus;	; White leghorn fowl; Adult	
Health Outcome:	Cancer/Carcinogenesis		
Chemical:	asbestos (CASRN 1332-21-4)-crocidolite (ri	ebeckite) (CASRN 12001-28-4)-amos	ite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651		
Domain	Metric	Rating	Comments
Overall Quali	ty Determination	Low	

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Study Citation: Duration: Exposure Route, Media, Path:	Peacock, P. R., Peacock, A. (1965). Asbestos-induced tumors in white leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503. Overall Duration: > 21 days; Exposure Duration: 0 - 4 days (0-96h) Terrestrial; N/A (e.g., injection); Injection					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticus</i> ; White leghorn fowl; Adult Mortality asbestos (CASRN 1332-21-4)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3664651					
Domain	Metric Rating Comments					
Domain 1: Test Substand						
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only. The study authors reported "0.5 ml. "asbestos" (of unknown origin) suspension in tributyrin"		
	Metric 2:	Test Substance Source	Low	The source of the asbestos was not reported. It was also not reported whether the as- bestos was analytically verfied.		
	Metric 3:	Test Substance Purity	Low	The size and distribution of the asbestos was not reported.		
Domain 2. Test Design						
Domain 2: Test Design	Metric 4:	Negative Controls	Low	It was not reported that a concurrent negative control was used for the study. However, the study authors reported that all other fowl grown in their line-bred fowl could be used as negative controls.		
	Metric 5:	Negative Control Response	Low	It was reported that all line-bred white leghorn fowl grown by the researchers had never experienced spontaneous lung tumors. This was reported in the text and was suggested to be the negative control.		
	Metric 6:	Randomized Allocation	Low	The researchers did not report how the fowl were allocated into study groups.		
Damain 2. Erra anna Ch						
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	Low	The study provided limited details on the preparation of the test substance and on the		
	Metric 8:	Preparation Consistency of Exposure Administration	High	test system. Finely ground asbestos powders were suspended in tributyrin. Details of exposure administration were reported, and exposures were administered con- sistently across study groups. All birds were injected with asbestos/tributyrin suspension in the right axillary air sac.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the exposure concentrations were measured or if analysis had been done on the asbestos fibers' concentration, size, and distribution.		
	Metric 10:	Exposure Duration and Frequency	High	This appears to be a lifelong study that is ongoing at the point that this paper was writ- ten. Exposure was via the one injection.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The purpose of the study was not to have a dose response, but to observe the pathologi- cal effects of asbestos injected into the air sacs of white leghorn fowl.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.		
Domain 4: Test Organisr	m Metric 13:	Test Organism Characteristics	Low	The scientific name of the test organisms was not given. It was not reported what the fowl were fed or how often they were fed. The source was not reported, but it was implied they were obtained from the laboratory performing the study.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the fowl were acclimatized to test conditions.		
			inued on ne	xt nage		

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	R., Peacock, A. (1965). Asbestos-induced t ation: > 21 days; Exposure Duration: 0 - 4 V/A (e.g., injection); Injection		ite leghorn fowls. Annals of the New York Academy of Sciences 132(1):501-503.		
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:						
Domain		Metric	Rating	Comments		
	Metric 15:	Number of Organisms and Replicates per Group	Low	In the first test, 6 birds were injected with asbestos. In the second test, 12 birds were injected with amosite and 12 birds were injected with crocidolite. This is a low quantity of organisms for a study.		
Domain 5: Outcome A	ssessment					
	Metric 16:	Adequacy of Test Conditions	Low	The housing and environmental conditions were not sufficiently reported to evaluate if they were adequate. The study did not report the feeding and watering regimen of the fowl either.		
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported. There was no infor- mation on how often the health of the fowl was observed or when a bird may have been euthanized for examination/necropsy.		
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited or not reported at all. There was not information provided as to when a fowl was euthanized for necropsy or how often fowl were observed for health/behavioral issues.		
Domain 6: Confoundir	og / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium	conditions—it was not reported whether the fowl were acclimatized to test conditions. There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Demein 7. Dete Deser						
Domain 7: Data Preser	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not per- formed.		
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a descrip- tion of a concurrent negative control. This paper appears to have been written as the study was ongoing, and thus there may have been more results reported after this paper was written.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	There were minor uncertainties regarding how the study characterized unexpected out- comes. Little information on methods used and methods assessment prevents characteri- zation of unexpected outcomes.		

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Study Citation: Duration: Exposure Route,	Peacock, P. R., Peacock, A. (1965). Asbest Overall Duration: > 21 days; Exposure Du Terrestrial; N/A (e.g., injection); Injection		owls. Annals of the New York Academy of Sciences 132(1):501-503.
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Avian; <i>Gallus gallus domesticu</i> Mortality asbestos (CASRN 1332-21-4)-crocidolite (3664651		nosite (grunerite) (CASRN 12172-73-5)
Domain	Metric	Rating	Comments
Additional Comments:	fibers, amosite and crocidolite on white leg paper was written, so there may have been how this paper can be used qualitatively giv	whorn fowl after being injected into the more results reported later. It is also ven that the purpose of the study was kicity study. No dose/response inform	ear; 0.5 ml dose. This paper was on the effects of undetermined asbestos he right axillary air sac. This study appears to be ongoing at the time this possible this is the reason for the lack of detail in this paper. It is unclear to observe the reaction of "mesothelial and pulmonary epithelial tissues of nation was provided. Animals were sacrificed at different time points and
Overall Qualit	ty Determination	Low	

Study Citation: Duration: Exposure Route, Media, Path:	Pelfrene, A. F. (1977). Early vascular modifications induced by asbestos fibers in the hamster cheek pouch. Microvascular Research 13(2):261-266. Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days Terrestrial; N/A (e.g., injection); Dermal (topical application)							
Taxa, Species, Age: Health Outcome:	Vertebrate; M Gastrointest	Mammalian; <i>Mesocricetus auratus</i> ; Not Appl inal	licable (e.g., fungi or alga	ae studies) or Not Reported				
Chemical:	(CASRN 17	· · · ·	te (riebeckite) (CASRN	12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite				
HERO ID:	3615254							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan			_					
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the asbestos fibers was not reported by the study authors.				
	Metric 3:	Test Substance Purity	Medium	All 5 types of asbestos fibers used were UICC standardized.				
Domain 2: Test Design								
C C	Metric 4:	Negative Controls	Uninformative	The study did not report the use of a negative control.				
	Metric 5:	Negative Control Response	Low	A biological response for a negative control was not reported in this study.				
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.				
Domain 3: Exposure Ch								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system was described adequately as the hamster cheek pouch where the asbestos fibers were implanted.				
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con sistently across study groups. Sanders and Shubik (1964) and Greenblatt et all (1969) were cited for the exposure administration using the transparent check method.				
	Metric 9:	Measurement of Test Substance Concentration	Low	The exposures were not reported to be analyzed by the performing laboratory. Only one exposure level for each fiber was used in the study.				
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was appropriate for the study type and outcome of interest, which was vascularization of the cheek after asbestos implantation. The exposure was for as long as the cheek pouch chamber's quality permitted examination. This was typically fo 8-12d.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent effect. The goal was to observe changes in the cheek pouch with different asbestos fibers.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble.				
Domain 4: Test Organis			т					
	Metric 13:	Test Organism Characteristics	Low	Female Syrian hamsters 20-24wks in age were used. The source of the animals was not reported.				
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the hamsters were acclimated to test conditions.				
	Metric 15:	Conditions Number of Organisms and	Medium	There were 5 experimental groups with 10 animals in each group.				
		Replicates per Group						

Study Citation:	Pelfrene, A. F. (1977). Early vascular modifications induced by asbestos fibers in the hamster cheek pouch. Microvascular Research 13(2):261-266.							
Duration:		ation: 11 - 21 days; Exposure Duration: 11 - 21		F				
Exposure Route,		N/A (e.g., injection); Dermal (topical applicatio						
Media, Path:	,							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mesocricetus auratus; Not Applica	able (e.g., fungi or al	gae studies) or Not Reported				
Health Outcome:	Gastrointesti							
Chemical:	chrysotile (s	serpentine) (CASRN 12001-29-5)-crocidolite	(riebeckite) (CASR	N 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite				
	(CASRN 17	068-78-9)						
HERO ID:	3615254							
Domain		Metric	Rating	Comments				
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	Medium	The hamsters were housed with one individual per plastic cage and fed a pellet diet with water continuously available. No information was reported on temperature or size of cages though.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest. Hamsters were examined daily under a microscope for vascularization of the cheek at the site of the asbestos implantation.				
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups-daily assessments were reported until the condition of the transparent cheek chamber had deteriorated.				
Domain 6: Confounding	Metric 19:		Low					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions—it was not reported if the hamsters were acclimated to the test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Present	ation and Anal	hais						
Domain 7. Data riesent	Metric 21:	Statistical Methods	N/A	This study focused on the pathological findings in the cheek tissue after asbestos fibers were implanted in the cheek pouch.				
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were reported for most, but not all, outcomes by treatment and control group–no findings for a control group were reported.				
	Metric 23:	Explanation of Unexpected Outcomes	High	The study did not report any unexpected outcomes. Variability was not reported because the results were pathological findings, and statistics were not performed on these.				
Additional Comments:	examined da		ntestinal outcome wa	lifferent asbestos fibers were implanted into the cheek pouch, which was as selected because this study was conducted in the mouth of the hamster thus the rating was unacceptable.				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	F. (1977). Early vascular modifications induation: 11 - 21 days; Exposure Duration: 11 - V/A (e.g., injection); Dermal (topical application)	21 days	the hamster cheek pouch. Microvascular Research 13(2):261-266.			
Taxa, Species, Age: Health Outcome: Chemical:	Vertebrate; Mammalian; <i>Mesocricetus auratus</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Gastrointestinal chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite						
HERO ID:	3615254	(CASRN 17068-78-9) 3615254					
Domain		Metric	Rating	Comments			
Domain 1: Test Substance							
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.			
	Metric 2:	Test Substance Source	Low	The source of the asbestos fibers was not reported by the study authors.			
	Metric 3:	Test Substance Purity	Medium	All 5 types of asbestos fibers used were UICC standardized.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	Uninformative	The study did not report the use of a negative control.			
	Metric 5:	Negative Control Response	Low	A biological response for a negative control was not reported in this study.			
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.			
Domain 3: Exposure Cha	aracterization						
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system was described adequately as the hamster cheek pouch where the asbestos fibers were implanted.			
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. Sanders and Shubik (1964) and Greenblatt et all (1969) were cited for the exposure administration using the transparent cheek method.			
	Metric 9:	Measurement of Test Substance Concentration	Low	The exposures were not reported to be analyzed by the performing laboratory. Only one exposure level for each fiber was used in the study.			
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was appropriate for the study type and outcome of interest, which was vascularization of the cheek after asbestos implantation. The exposure was for as long as the cheek pouch chamber's quality permitted examination. This was typically fo 8-12d.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent effect. The goal was to observe changes in the cheek pouch with different asbestos fibers.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble.			
Domain 4: Test Organisr	m						
Domain 4. Test Organisi	Metric 13:	Test Organism Characteristics	Low	Female Syrian hamsters 20-24wks in age were used. The source of the animals was not reported.			
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the hamsters were acclimated to test conditions.			
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	There were 5 experimental groups with 10 animals in each group.			

Study Citation:	Pelfrene, A.	Pelfrene, A. F. (1977). Early vascular modifications induced by asbestos fibers in the hamster cheek pouch. Microvascular Research 13(2):261-266.					
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,	Terrestrial; N	Terrestrial; N/A (e.g., injection); Dermal (topical application)					
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	/ertebrate; Mammalian; Mesocricetus auratus; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Gastrointesti						
Chemical:	•	· · · ·	(riebeckite) (CASR	N 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite			
HERO ID:	(CASRN 17) 3615254	068-78-9)					
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	Medium	The hamsters were housed with one individual per plastic cage and fed a pellet diet with water continuously available. No information was reported on temperature or size of cages though.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest. Hamsters were examined daily under a microscope for vascularization of the cheek at the site of the asbestos implantation.			
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups-daily assessments were reported until the condition of the transparent cheek chamber had deteriorated.			
Domain 6: Confounding	/ Variable Co	ntrol					
Domain 0. Comounaing	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures	2011	conditions—it was not reported if the hamsters were acclimated to the test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	N/A	This study focused on the pathological findings in the cheek tissue after asbestos fibers were implanted in the cheek pouch.			
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were reported for most, but not all, outcomes by treatment and control group–no findings for a control group were reported.			
	Metric 23:	Explanation of Unexpected Outcomes	High	The study did not report any unexpected outcomes. Variability was not reported becaus the results were pathological findings, and statistics were not performed on these.			
Additional Comments:	examined da		ntestinal outcome wa	different asbestos fibers were implanted into the cheek pouch, which was as selected because this study was conducted in the mouth of the hamster hus the rating was unacceptable.			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	F. (1977). Early vascular modifications induation: 11 - 21 days; Exposure Duration: 11 - V/A (e.g., injection); Dermal (topical application)	21 days	the hamster cheek pouch. Microvascular Research 13(2):261-266.			
Taxa, Species, Age: Health Outcome: Chemical:	Vertebrate; Mammalian; <i>Mesocricetus auratus</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Gastrointestinal chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite						
HERO ID:	3615254	(CASRN 17068-78-9) 3615254					
Domain		Metric	Rating	Comments			
Domain 1: Test Substance							
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.			
	Metric 2:	Test Substance Source	Low	The source of the asbestos fibers was not reported by the study authors.			
	Metric 3:	Test Substance Purity	Medium	All 5 types of asbestos fibers used were UICC standardized.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	Uninformative	The study did not report the use of a negative control.			
	Metric 5:	Negative Control Response	Low	A biological response for a negative control was not reported in this study.			
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.			
Domain 3: Exposure Cha	aracterization						
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system was described adequately as the hamster cheek pouch where the asbestos fibers were implanted.			
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. Sanders and Shubik (1964) and Greenblatt et all (1969) were cited for the exposure administration using the transparent cheek method.			
	Metric 9:	Measurement of Test Substance Concentration	Low	The exposures were not reported to be analyzed by the performing laboratory. Only one exposure level for each fiber was used in the study.			
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was appropriate for the study type and outcome of interest, which was vascularization of the cheek after asbestos implantation. The exposure was for as long as the cheek pouch chamber's quality permitted examination. This was typically fo 8-12d.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent effect. The goal was to observe changes in the cheek pouch with different asbestos fibers.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble.			
Domain 4: Test Organisr	m						
Domain 4. Test Organisi	Metric 13:	Test Organism Characteristics	Low	Female Syrian hamsters 20-24wks in age were used. The source of the animals was not reported.			
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the hamsters were acclimated to test conditions.			
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	There were 5 experimental groups with 10 animals in each group.			

Study Citation:	Pelfrene, A.	F. (1977). Early vascular modifications induced	d by asbestos fibers in	n the hamster cheek pouch. Microvascular Research 13(2):261-266.				
Duration:		ation: 11 - 21 days; Exposure Duration: 11 - 21						
Exposure Route,		V/A (e.g., injection); Dermal (topical application						
Media, Path:								
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; <i>Mesocricetus auratus</i> ; Not Applicable (e.g., fungi or algae studies) or Not Reported Gastrointestinal						
Health Outcome:	Gastrointesti							
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)-anthophyllite (CASRN 17068-78-9)							
HERO ID:								
Domain		Metric	Rating	Comments				
	Metric 16:	Adequacy of Test Conditions	Medium	The hamsters were housed with one individual per plastic cage and fed a pellet diet with water continuously available. No information was reported on temperature or size of cages though.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest. Hamsters were examined daily under a microscope for vascularization of the cheek at the site of the asbestos implantation.				
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups-daily assessments were reported until the condition of the transparent cheek chamber had deteriorated.				
Domain 6: Confounding	, / Variable Co	atral						
Domain 0. Confounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
	incure 17.	Design and Procedures	2011	conditions—it was not reported if the hamsters were acclimated to the test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Present	ation and Anal	vsis						
	Metric 21:	Statistical Methods	N/A	This study focused on the pathological findings in the cheek tissue after asbestos fibers were implanted in the cheek pouch.				
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were reported for most, but not all, outcomes by treatment and control group–no findings for a control group were reported.				
	Metric 23:	Explanation of Unexpected Outcomes	High	The study did not report any unexpected outcomes. Variability was not reported because the results were pathological findings, and statistics were not performed on these.				
Additional Comments:	examined da		ntestinal outcome wa	ifferent asbestos fibers were implanted into the cheek pouch, which was as selected because this study was conducted in the mouth of the hamster hus the rating was unacceptable.				

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde			
		vironmental Health Perspectives 53:25-N					
Duration:		ation: > 21 days; Exposure Duration: > 2	I days				
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Mesocricetus auratus</i> ; Adult Development/Growth chrysotile (serpentine) (CASRN 12001-29-5)						
Taxa, Species, Age:							
Health Outcome:							
Chemical:							
HERO ID:	709665						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan	ice						
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.			
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.			
Domain 3: Exposure Ch	naracterization						
r	Metric 7:	Experimental System/Test Media Preparation	Medium	The experimental system was described in adequate detail. Methods for preparation of test media were minimal.			
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.			
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure concentration.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organis	m						
2 smann 1. 10st Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.			
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological			
		Replicates per Group		effects.			
Domain 5: Outcome As	sessment						
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.			
		Cont	tinued on nex	t page			

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ha Duration: O Exposure Route, Te Media, Path: Taxa, Species, Age: Ve Health Outcome: D Chemical: ch HERO ID: 70 Domain	hamsters. En Overall Dura Ferrestrial; F Vertebrate; M Development	vironmental Health Perspectives 53:25-No tion: > 21 days; Exposure Duration: > 21 'ood/Diet; Dietary Aammalian; <i>Mesocricetus auratus</i> ; Adult	v.	Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde
Duration: O Exposure Route, Ta Media, Path: Taxa, Species, Age: Va Taxa, Species, Age: Da Health Outcome: Da Chemical: ch HERO ID: 70 Domain Data	Overall Dura Ferrestrial; F Vertebrate; M Development chrysotile (se	tion: > 21 days; Exposure Duration: > 21 ood/Diet; Dietary /ammalian; <i>Mesocricetus auratus</i> ; Adult t/Growth		
Exposure Route,TeMedia, Path:Taxa, Species, Age:VeTaxa, Species, Age:DeChealth Outcome:DeChemical:cheHERO ID:70Domain	Ferrestrial; F Vertebrate; N Development chrysotile (se	ood/Diet; Dietary Iammalian; <i>Mesocricetus auratus</i> ; Adult t/Growth		
Media, Path:Taxa, Species, Age:VolumeHealth Outcome:DiChemical:chemical:HERO ID:70DomainComain	Vertebrate; M Development chrysotile (se	Iammalian; <i>Mesocricetus auratus</i> ; Adult t/Growth		
Health Outcome: D. Chemical: ch HERO ID: 70 Domain	Development chrysotile (se	t/Growth		
Chemical: ch HERO ID: 7(Domain	chrysotile (se			
HERO ID: 70 Domain	•	erpentine) (CASRN 12001-29-5)		
Domain	709665			
М		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment		
Domain 6: Confounding / V	Variable Cor	ntrol		
-	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.
		Design and Procedures	U	
М	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.
Domain 7: Data Presentation	on and Analy	veis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	Metric 22:	Reporting of Data	Low	Results were described in the text.
М	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments: TI	This portion	of the study assessed body weight for shor	t range fibers	S.
Overall Quality 1		•	High	

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde			
Duration:		nvironmental Health Perspectives $53:25$ -No ation: > 21 days; Exposure Duration: > 21					
Exposure Route,		Food/Diet; Dietary	days				
Media, Path:	Terrestriar, I	ood/Diet, Dietal y					
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Adult						
Health Outcome:	Developmen						
Chemical:	1	inerite) (CASRN 12172-73-5)					
HERO ID:	709665	mente) (CASKIV 12172-75-5)					
Domain	707005	Metric	Rating	Comments			
Domain 1: Test Substand	e	Wette	Kating	connients			
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.			
			111811				
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.			
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.			
Domain 3: Exposure Cha	aracterization						
Bomain 5. Exposure en	Metric 7:	Experimental System/Test Media	Medium	The experimental system was described in adequate detail. Methods for preparation of			
		Preparation		test media were minimal.			
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.			
	Matria O.	Administration	T				
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.			
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for			
				the study type.			
	Metric 11:	Number of Exposure Groups/	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure			
		Spacing of Exposure Levels		concentration.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organisr	n						
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.			
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			
	36.1.1.7	Conditions	-				
	Metric 15:	Number of Organisms and	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological			
		Replicates per Group		effects.			
Domain 5: Outcome Ass	essment						
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					

				Fully fully		
Study Citation:		E. E., Shefner, A. M., Rust, J. H., Moore, J. wironmental Health Perspectives 53:25-No		Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mesocricetus auratus; Adult				
Health Outcome:	Development/Growth					
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	709665					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	Low	Results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	This portion	of the study assessed organism body weigl	nt.			
Overall Qualit	ty Detern	nination	High			

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde			
Duration:		nvironmental Health Perspectives 53:25-N ation: > 21 days; Exposure Duration: > 2					
Exposure Route,		Food/Diet; Dietary	1 duys				
Media, Path:	Terrestriar, I	i oodi Dict, Dictary					
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Adult						
Health Outcome:	Mortality						
Chemical:	•	serpentine) (CASRN 12001-29-5)					
HERO ID:	709665						
Domain		Metric	Rating	Comments			
Domain 1: Test Substand	ce						
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.			
Domain 2: Test Design							
····· = ····B··	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.			
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.			
Domain 3: Exposure Ch	aracterization						
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media	Medium	The experimental system was described in adequate detail. Methods for preparation of			
	Wieure 7.	Preparation	Wiedium	test media were minimal.			
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.			
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for			
			-	the study type.			
	Metric 11:	Number of Exposure Groups/	N/A	The study goal was not to have a dose-dependent effect and there is only one exposure			
		Spacing of Exposure Levels		concentration.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organisi	n						
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.			
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological			
		Replicates per Group		effects.			
Domain 5: Outcome Ass	sessment						
Zoman 5. Outcome As	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
		4 1000001110111					

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continued from previous page							
Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golder			
D		vironmental Health Perspectives 53:25-No					
Duration:		ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,	Terrestrial; F	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Adult						
Health Outcome:	Mortality						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	709665						
	Metric Rating Comments						
Domain		Metric	Rating	Comments			
	g / Variable Cor Metric 19:	ntrol Confounding Variables in Test	Rating High	Comments There were no reported differences among the study groups in environmental conditions.			
		ntrol	C				
Domain 6: Confounding	Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High	There were no reported differences among the study groups in environmental conditions.			
Domain 6: Confounding	Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High Medium	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.			
Domain Domain 6: Confounding Domain 7: Data Presenta	Metric 19: Metric 20: ation and Anal	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	High	There were no reported differences among the study groups in environmental conditions.			

Overall Quality Determination

High

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde
Duration:		nvironmental Health Perspectives 53:25-Ne ation: > 21 days; Exposure Duration: > 2		
Exposure Route,		Food/Diet; Dietary	i dujo	
Media, Path:	10110501101,1			
Taxa, Species, Age:	Vertebrate; 1	Mammalian; Mesocricetus auratus; Adult		
Health Outcome:	Mortality	,		
Chemical:	amosite (gru	inerite) (CASRN 12172-73-5)		
HERO ID:	709665			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.
Domain 2: Test Design				
8	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Ch	aracterization			
Johnani J. Exposure en	Metric 7:	Experimental System/Test Media	Medium	The experimental system was described in adequate detail. Methods for preparation of
	incure /.	Preparation	meanum	test media were minimal.
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure
		Spacing of Exposure Levels		concentration.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisi	m			
-	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
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Study Citation:		E. E., Shefner, A. M., Rust, J. H., Moore, J. wironmental Health Perspectives 53:25-No		Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden		
Duration:	Overall Dura	tion: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	ood/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Aammalian; Mesocricetus auratus; Adult				
Health Outcome:	Mortality					
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	709665					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Con Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High Medium	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	This portion	of the study assessed the life span of the or	rganisms.			
Overall Qualit	ty Detern	nination	High			

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde
Duration:		nvironmental Health Perspectives $53:25-Nc$ ation: > 21 days; Exposure Duration: > 21		
Exposure Route,		Food/Diet; Dietary	augs a	
Media, Path:	10110301101, 1			
Taxa, Species, Age:	Vertebrate; I	Mammalian; Mesocricetus auratus; Adult		
Health Outcome:	Cancer/Carc			
Chemical:		inerite) (CASRN 12172-73-5)		
HERO ID:	709665			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.
Domain 2: Test Design				
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Cha				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The experimental system was described in adequate detail. Methods for preparation of test media were minimal.
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure concentration.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisr				
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological effects.
		· · · ·		
Domain 5: Outcome Ass				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.

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Study Citation:						
orday citation.				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde		
		vironmental Health Perspectives 53:25-No				
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Aammalian; Mesocricetus auratus; Adult				
Health Outcome:	Cancer/Carcinogenesis					
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	709665					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Coi	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High Medium	There were no reported differences among the study groups in environmental conditions. There were no differences among groups.		
Domain 7: Data Present	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	U			
Domain 7: Data Present	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure	Medium			
Domain 7: Data Present	Metric 20:	Design and Procedures Outcomes Unrelated to Exposure ysis Statistical Methods	Medium	There were no differences among groups. Statistical methods were adequately described.		
Domain 7: Data Present	Metric 20: tation and Anal Metric 21:	Design and Procedures Outcomes Unrelated to Exposure ysis	Medium	There were no differences among groups.		

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde				
Duration:		nvironmental Health Perspectives $53:25-N_{0}$ ation: > 21 days; Exposure Duration: > 2						
Exposure Route,		Food/Diet; Dietary	1 days					
Media, Path:	Terrestriar, I							
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Adult							
Health Outcome:	Cancer/Carcinogenesis							
Chemical:								
HERO ID:	709665	erpentine) (CASRN 12001-29-5)						
Domain	107005	Metric	Rating	Comments				
Domain 1: Test Substand	re	Wette	Rating	Connicity				
Domain 1. 10st Substant	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.				
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.				
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.				
	metrie 5.	Test Substance Funty	mgn	riber endratensites and impartices were wen documented.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.				
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.				
Domain 3: Exposure Cha								
	Metric 7:	Experimental System/Test Media Preparation	Medium	The experimental system was described in adequate detail. Methods for preparation of test media were minimal.				
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.				
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure concentration.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.				
			1.011					
Domain 4: Test Organisr	n							
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.				
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological effects.				
		Replicates per Group						
Domain 5: Outcome Ass	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.				
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.				
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.				
		7.00000m0m						

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		conti	nued from p	revious page	
Study Citation:	Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden				
Duration:	hamsters. Environmental Health Perspectives 53:25-Nov. Overall Duration: > 21 days; Exposure Duration: > 21 days				
Exposure Route,		Terrestrial; Food/Diet; Dietary			
Media, Path:	Terresulai, I	Terrestrial; Food/Diet; Dietary			
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Adult				
Health Outcome:					
Chemical:	Cancer/Carcinogenesis chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	709665	(Cribid 12001 2) 5)			
Domain		Metric	Rating	Comments	
Domain 6: Confounding	/ Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.	
		Design and Procedures			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.	
Domain 7: Data Present	ation and Anal	vsis			
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.	
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.	
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.	
Additional Comments:	This portion	of the study assessed tumors in organisms	exposed to s	hort range fibers.	
			•		
Overall Qualit	y Detern	nination	High		

Study Citation:	Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden hamstere. Environmental Health Desenatives 52:25 Nev.			
Duration:		nvironmental Health Perspectives 53:25-N ation: > 21 days; Exposure Duration: > 2		
Exposure Route,		Food/Diet; Dietary	1 duys	
Media, Path:	Terrestriar, I	lood/Diet, Dietary		
Taxa, Species, Age:	Vertebrate: 1	Mammalian; Mesocricetus auratus; Adult		
Health Outcome:	Mortality	Manimanan, mesoerreetas auratas, radat		
Chemical:	•	serpentine) (CASRN 12001-29-5)		
HERO ID:				
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce		0	
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.
Domain 2: Test Design				
Domain 2. Tost Dosign	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The experimental system was described in adequate detail. Methods for preparation of test media were minimal.
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure concentration.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis			17. 1	
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Ass		A deguage of Test Car Hiters	TT: -1-	Environmental and Malana and the state and an and the state of the sta
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.

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		contin	nued from p	revious page		
Study Citation:	Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden					
Duration:		hamsters. Environmental Health Perspectives 53:25-Nov. Overall Duration: > 21 days; Exposure Duration: > 21 days				
Exposure Route,			uays			
Media, Path:	Terresultar, r	Terrestrial; Food/Diet; Dietary				
· · · · · · · · · · · · · · · · · · ·	Vartabrata: N	Marta Marta Marta Line Marta and Adala				
Taxa, Species, Age: Health Outcome:	,	Vertebrate; Mammalian; <i>Mesocricetus auratus</i> ; Adult				
Chemical:	Mortality					
HERO ID:	709665	erpentine) (CASRN 12001-29-5)				
HERO ID:	709003					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Cor Metric 19:	ntrol Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.		
Domain 7: Data Present	ation and Anal Metric 21:	ysis Statistical Methods	High	Statistical methods were adequately described.		
	Metric 21:	Reporting of Data		Data for exposure-related findings were presented for each treatment and control group.		
	Metric 22:	Explanation of Unexpected Outcomes	High High	Unexpected outcomes were satisfactorily explained.		
	metric 23.	Explanation of Onexpected Outcomes	mgn	chespected outcomes were satisfactority explained.		
Additional Comments:	This portion	of the study assessed the life span of the or	rganisms exp	osed to short range fibers.		
Overall Quality Determination High						

Study Citation:				Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golde
Duration:		nvironmental Health Perspectives $53:25$ -Ne ation: > 21 days; Exposure Duration: > 2		
Exposure Route,		Food/Diet; Dietary	1 days	
Media, Path:	Terrestriar, I	ood/Diet, Dietary		
Taxa, Species, Age:	Vertebrate: 1	Mammalian; Mesocricetus auratus; Adult		
Health Outcome:	Developmer			
Chemical:	1	erpentine) (CASRN 12001-29-5)		
HERO ID:	709665			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Cha				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The experimental system was described in adequate detail. Methods for preparation of test media were minimal.
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure concentration.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis		Test Organism Characteristics	High	The test successions many adapted by described and many alternal from a well-bla accurate
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Ass				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or- ganism health.
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
		Assessment		

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Study Citation:		E. E., Shefner, A. M., Rust, J. H., Moore, J. wironmental Health Perspectives 53:25-No		Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden		
Duration:		Diverall Duration: > 21 days; Exposure Duration: > 21 days				
Exposure Route,		Terrestrial; Food/Diet; Dietary				
Media, Path:	,					
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Mesocricetus auratus; Adult				
Health Outcome:	Developmen	Development/Growth				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	709665					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Con Metric 19:	ntrol Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	Low	Results were described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	This portion	of the evaluation assessed organism body	weight for in	termediate range fiber exposre.		
Overall Qualit	t v Detern	nination	High			

Study Citation:	tion: Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden hamsters. Environmental Health Perspectives 53:25-Nov.						
Duration:		nvironmental Health Perspectives 53:25-No ation: > 21 days; Exposure Duration: > 21					
Exposure Route,		Food/Diet; Dietary	i days				
Media, Path:	Terresultar, I	rood/Diet, Dietary					
Taxa, Species, Age:	Vertebrate: 1	Mammalian; Mesocricetus auratus; Adult					
Health Outcome:	Cancer/Carc						
Chemical:		serpentine) (CASRN 12001-29-5)					
HERO ID:	709665						
Domain	107005	Metric	Rating	Comments			
Domain 1: Test Substand	re	Mette	Rating	Comments			
Domain 1. 10st Substant	Metric 1:	Test Substance Identity	Low	The CAS number was not provided.			
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	High	Fiber characteristics and impurities were well documented.			
	incure 5.		mgn	rior enalgements and imparties were were documented.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and suitable.			
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.			
Domain 3: Exposure Cha							
	Metric 7:	Experimental System/Test Media	Medium	The experimental system was described in adequate detail. Methods for preparation of			
	M (' 0	Preparation		test media were minimal.			
	Metric 8:	Consistency of Exposure	Medium	Reporting omissions are unlikely to have a substantial impact on results.			
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for			
				the study type.			
	Metric 11:	Number of Exposure Groups/	N/A	The study goal was not to have a dose-dependent effect, and there is only one exposure			
		Spacing of Exposure Levels		concentration.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organisr	n						
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.			
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.			
		Conditions					
	Metric 15:	Number of Organisms and	Medium	The numbers of test organisms were reported and sufficient to characterize toxicological			
		Replicates per Group		effects.			
Domain 5: Outcome Ass	ecoment						
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of or-			
	Methe 10.	Auquacy of test conditions	Ingn	ganism health.			
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment	č				

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		contin	nued from p	revious page		
Study Citation:		Mcconnell, E. E., Shefner, A. M., Rust, J. H., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite and chrysotile asbestos in Syrian golden				
Duration:		hamsters. Environmental Health Perspectives 53:25-Nov. Overall Duration: > 21 days; Exposure Duration: > 21 days				
Exposure Route,		Terrestrial; Food/Diet; Dietary				
Media, Path:	Terrestriar, I	Tenesulai, Food/Dict, Dictary				
Taxa, Species, Age:	Vertebrate: N	Vertebrate: Mammalian; Mesocricetus auratus; Adult				
Health Outcome:	,	, , , , , , , , , , , , , , , , , , , ,				
Chemical:		Cancer/Carcinogenesis chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	709665					
Domain		Metric	Rating	Comments		
		_				
Domain 6: Confounding	-					
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions.		
	M + 1 20	Design and Procedures				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There were no differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	This portion	of the study assessed for tumors during ex	posure to inte	ermediate range fibers.		
			·	-		
Overall Quali	ty Detern	nination	High			

Study Citation:	Smith, W. E., Hubert, D. D., Sobel, H. J., Peters, E. T., Doerfler, T. E. (1980). Health of experimental animals drinking water with and without amosite asbestos and other mineral particles. Journal of Environmental Pathology and Toxicology 3(5-6):277-300.								
Duration:				blogy and Toxicology 3(5-6):277-300.					
Exposure Route,	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary								
Media, Path:	זרורכאוומו, ריטטע בוכו, בוכומוץ								
Taxa, Species, Age:	Vertebrate: I	Vertebrate; Mammalian; Mesocricetus auratus; Lak:LVG; Juvenile							
Health Outcome:	Mortality amosite (grunerite) (CASRN 12172-73-5)								
Chemical:									
HERO ID:	3581049								
Domain		Metric	Rating	Comments					
Domain 1: Test Substand									
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.					
	Metric 2:	Test Substance Source	High	The source of the amosite was from the Pneumoconiosis Research Unit, Council for Scientific and Industrial Research in Johannesburg, South Africa. The taconite tailings were from Reserve Mining Company in Silver Bay, MN. The beach rocks were col- lected from the Baptism and Beaver river mouths near Silver Bay. All test substances were analyzed for fiber size and distribution.					
	Metric 3:	Test Substance Purity	Medium	Fiber size and distribution were analyzed for each test substance.					
Domain 2: Test Design									
Domain 2. Test Design	Metric 4:	Negative Controls	High	The study authors reported that Groups 9 and 10 were used as untreated controls.					
	Metric 5:	Negative Control Response	High	Survivorship of the controls was adequate and can be seen in Tables 3, 4, and 5.					
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.					
Domain 3: Exposure Ch	aracterization								
	Metric 7:	Experimental System/Test Media Preparation	High	Stock solutions of the minerals were diluted to get the proper test concentrations. The test concentrations were examined under optical and electron microscopes for determination of fiber size and distribution.					
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. Exposures were administered via drinking water across all study groups.					
	Metric 9:	Measurement of Test Substance Concentration	High	Optical and electron microscopy were used to determine fiber concentration and distri- bution of each concentration of fibers used in this study. This can be found in Tables 1 and 2.					
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was for the lifetime of the hamsters.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	There were 3 treatment levels each for the amosite and tailings groups, 2 treatment levels for the beach rocks group, and 2 negative control groups. This was adequate to see a response.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.					
	· ·								
Domain 4: Test Organisi	m								
	Metric 13:	Test Organism Characteristics	High	The species of the golden variety were used for this study. Organisms were obtained from Charles River Breeding Laboratories Lakeview Hamster Colony in New Jersey. Feeding was described in the "Materials and Methods" section.					
		Cont	inued on nex	4					

		conti	nued from p	revious page		
Study Citation:		Smith, W. E., Hubert, D. D., Sobel, H. J., Peters, E. T., Doerfler, T. E. (1980). Health of experimental animals drinking water with and without amosite asbestos and other mineral particles. Journal of Environmental Pathology and Toxicology 3(5-6):277-300.				
Duration:		ation: > 21 days; Exposure Duration: > 21		ology and Toxicology 5(5-0).277-500.		
Exposure Route,		Food/Diet; Dietary	j			
Media, Path:	,-					
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Mesocricetus auratus</i> ; Lak:LV	G; Juvenile			
Health Outcome:		Mortality				
Chemical:	•	amosite (grunerite) (CASRN 12172-73-5)				
HERO ID:	3581049					
Domain		Metric	Rating	Comments		
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the organism were acclimated to test conditions.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	It was reported that there were 60 hamsters in each group of the study.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	High	It was reported that there were 10 animals per cage, which were provided the correct type of drinking water. Animals were fed pelleted food daily that was supplemented with fresh produce.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-survival.		
	Metric 18:	Consistency of Outcome Assessment	High	The hamsters were assessed if they died within the course of the experiment or if they were moribund. All hamsters were necropsied by December 1975 if they had not died before then.		
Domain 6: Confounding	y / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions—it was not reported if the animals were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	Low	The study reported confidence limits for survival (Table 4), but statistics were not described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest. Survival data was reported for all groups in Table 3. Confidence limits were reported in Table 4.		
	Metric 23:	Explanation of Unexpected Outcomes	High	The study authors did not report any unexpected outcomes.		
Additional Comments:	exposed to g			used to asbestos and taconite tailings via drinking water. There were two groups also controls that were given filtered Lake Superior water. This evaluation was done or		

Overall Quality Determination	High

Domain 4: Test Organism

Study Citation: Duration: Exposure Route, Media, Path:	asbestos and Overall Dur	E., Hubert, D. D., Sobel, H. J., Peters, E. d other mineral particles. Journal of Envir ation: > 21 days; Exposure Duration: > 2 Food/Diet; Dietary	onmental Path	¹ E. (1980). Health of experimental animals drinking water with and without amo ology and Toxicology 3(5-6):277-300.
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Cancer/Carc	Mammalian; <i>Mesocricetus auratus</i> ; Lak:I cinogenesis unerite) (CASRN 12172-73-5)	.VG; Juvenile	
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.
	Metric 2:	Test Substance Source	High	The source of the amosite was from the Pneumoconiosis Research Unit, Council for Scientific and Industrial Research in Johannesburg, South Africa. The taconite tailings were from Reserve Mining Company in Silver Bay, MN. The beach rocks were col- lected from the Baptism and Beaver river mouths near Silver Bay. All test substances were analyzed for fiber size and distribution.
	Metric 3:	Test Substance Purity	Medium	Fiber size and distribution were analyzed for each test substance.
Demain 2. Test Design				
Domain 2: Test Design	Metric 4:	Negative Controls	High	The study authors reported that Groups 9 and 10 were used as untreated controls.
	Metric 5:	Negative Control Response	High	The negative control response was adequate and can be found in Tables 7 and 8.
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.
Domain 3: Exposure Ch			II:-1	
	Metric 7:	Experimental System/Test Media Preparation	High	Stock solutions of the minerals were diluted to get the proper test concentrations. The test concentrations were examined under optical and electron microscopes for determination of fiber size and distribution.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. Exposures were administered via drinking water across all study groups.
	Metric 9:	Measurement of Test Substance Concentration	High	Optical and electron microscopy were used to determine fiber concentration and distribution of each concentration of fibers used in this study. This can be found in Tables 1 and 2.
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was for the lifetime of the hamsters.

Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	There were 3 treatment levels each for the amosite and tailings groups, 2 treatment levels for the beach rocks group, and 2 negative control groups. This was adequate to see a response.
Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.
m Metric 13:	Test Organism Characteristics	High	The species of the golden variety were used for this study. Organisms were obtained

 Metric 13:
 Test Organism Characteristics
 High
 The species of the golden variety were used for this study. Organisms were obtained from Charles River Breeding Laboratories Lakeview Hamster Colony in New Jersey. Feeding was described in the "Materials and Methods" section.

 Metric 14:
 Acclimatization and Pretreatment Conditions
 Low
 It was not reported if the organism were acclimated to test conditions.

Study Citation:	Smith, W. E., Hubert, D. D., Sobel, H. J., Peters, E. T., Doerfler, T. E. (1980). Health of experimental animals drinking water with and without amosit						
Duration:	Notice Terrestrial; Food/Diet; Dietary Jia, Path: Vertebrate; Mammalian; Mesocricetus auratus; Lak:LVG; Juvenile Ith Outcome: Cancer/Carcinogenesis						
Exposure Route,							
Media, Path:							
Chemical:							
HERO ID:	3581049						
Domain		Metric	Rating	Comments			
	Metric 15:	Number of Organisms and Replicates per Group	Medium	It was reported that there were 60 hamsters in each group of the study.			
Domain 5: Outcome As	sessment						
	Metric 16:	Adequacy of Test Conditions	High	It was reported that there were 10 animals per cage, which were provided the correct type of drinking water. Animals were fed pelleted food daily that was supplemented with fresh produce.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-cancer formation.			
	Metric 18:	Consistency of Outcome Assessment	High	The hamsters were assessed if they died within the course of the experiment or if they were moribund. All hamsters were necropsied by December 1975 if they had not died before then. Body weights were taken at various intervals throughout the study.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions—it was not reported if the animals were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	N/A	This portion of the study focused on pathology, and thus statistics were not performed.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest. Weight data can be seen in Tables 7 and 8.			
	Metric 23:	Explanation of Unexpected Outcomes	High	The study authors did not report any unexpected outcomes.			
Additional Comments:	This was a long term hamster study where the hamsters were exposed to asbestos and taconite tailings via drinking water. There were two groups all exposed to ground beach rock and two groups that were used as controls that were given filtered Lake Superior water. This evaluation was done on the pathological findings in the paper.						

Study Citation:	Smith, W. E., Hubert, D. D., Sobel, H. J., Peters, E. T., Doerfler, T. E. (1980). Health of experimental animals drinking water with and without amosit asbestos and other mineral particles. Journal of Environmental Pathology and Toxicology 3(5-6):277-300.							
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Terrestrial; Food/Diet; Dietary							
Media, Path:								
Taxa, Species, Age:	Vertebrate; Mammalian; Mesocricetus auratus; Lak:LVG; Juvenile							
Health Outcome:	Development/Growth							
Chemical:	amosite (grunerite) (CASRN 12172-73-5)							
HERO ID:	3581049							
Domain		Metric	Rating	Comments				
Domain 1: Test Substa	nce	metric	Runng	connicits				
Domain 1. Test Substa	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.				
	Metric 2:	Test Substance Source	High	The source of the amosite was from the Pneumoconiosis Research Unit, Council for Scientific and Industrial Research in Johannesburg, South Africa. The taconite tailings were from Reserve Mining Company in Silver Bay, MN. The beach rocks were col- lected from the Baptism and Beaver river mouths near Silver Bay. All test substances were analyzed for fiber size and distribution.				
	Metric 3.	Test Substance Purity	Medium	Fiber size and distribution were analyzed for each test substance				

				were analyzed for fiber size and distribution.
	Metric 3:	Test Substance Purity	Medium	Fiber size and distribution were analyzed for each test substance.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	The study authors reported that Groups 9 and 10 were used as untreated controls.
	Metric 5:	Negative Control Response	High	The negative control response was adequate and can be found in Tables 5, 6a, and 6b.
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the hamsters were allocated into study groups.
Domain 3: Exposure Cha	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	Stock solutions of the minerals were diluted to get the proper test concentrations. The test concentrations were examined under optical and electron microscopes for determination of fiber size and distribution.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported, and exposures were administered con- sistently across study groups. Exposures were administered via drinking water across all study groups.
	Metric 9:	Measurement of Test Substance Concentration	High	Optical and electron microscopy were used to determine fiber concentration and distribution of each concentration of fibers used in this study. This can be found in Tables 1 and 2.
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was for the lifetime of the hamsters.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	There were 3 treatment levels each for the amosite and tailings groups, 2 treatment levels for the beach rocks group, and 2 negative control groups. This was adequate to see a response.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble chemical.
Domain 4: Test Organisr	n			
	Metric 13:	Test Organism Characteristics	High	The species of the golden variety were used for this study. Organisms were obtained from Charles River Breeding Laboratories Lakeview Hamster Colony in New Jersey. Feeding was described in the "Materials and Methods" section.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported if the organism were acclimated to test conditions.
		Cont	inued on nex	xt page

Study Citation:	Smith, W. E	., Hubert, D. D., Sobel, H. J., Peters, E. T.	. Doerfler. T	. E. (1980). Health of experimental animals drinking water with and without amosite
•	asbestos and	other mineral particles. Journal of Enviror	mental Path	
Duration:		ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,	Terrestrial; F	Food/Diet; Dietary		
Media, Path:	X 7 (1 ()			
Taxa, Species, Age:		Mammalian; <i>Mesocricetus auratus</i> ; Lak:LV	G; Juvenile	
Health Outcome: Chemical:	Developmen	inerite) (CASRN 12172-73-5)		
HERO ID:	3581049	lilente) (CASKN 12172-75-3)		
	5581049			2
Domain		Metric	Rating	Comments
	Metric 15:	Number of Organisms and Replicates per Group	Medium	It was reported that there were 60 hamsters in each group of the study.
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	High	It was reported that there were 10 animals per cage, which were provided the correct type of drinking water. Animals were fed pelleted food daily that was supplemented with fresh produce.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-weight/growth.
	Metric 18:	Consistency of Outcome Assessment	High	The hamsters were assessed if they died within the course of the experiment or if they were moribund. All hamsters were necropsied by December 1975 if they had not died before then. Body weights were taken at various intervals throughout the study.
Domain 6: Confounding	y / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-it was not reported if the animals were acclimated to test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.
Domain 7: Data Present	ation and Anal	ysis		
	Metric 21:	Statistical Methods	High	ANOVA was used to test the differences in weights in each group.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest. Weight data can be seen in Tables 5, 6a, and 6b.
	Metric 23:	Explanation of Unexpected Outcomes	High	The study authors did not report any unexpected outcomes.
Additional Comments:	exposed to g		ere used as	sed to asbestos and taconite tailings via drinking water. There were two groups als controls that were given filtered Lake Superior water. This evaluation was done o
Overall Qualit	v Deterr	nination	High	

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Study Citation: Duration: Exposure Route, Media, Path:	Overall Dur	 Maurer, R. R. (1977). Asbestos and embration: 11 - 21 days; Exposure Duration: 0 - Cell Culture Media; Not determined by stud 	4 days (0-96h)	ent. Teratology 15(3):273-279. nemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Reproductiv	Mammalian; <i>Mus musculus</i> ; CD-1; Embryo re/Teratogenic erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	A BMOC-3 medium control group was included.
	Metric 5:	Negative Control Response	High	The biological response of the control group was shown in Table 2 and appears reason- able.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Ch	aracterization Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations in BMOC-3 medium.
	Metric 8:	Consistency of Exposure Administration	High	The exposure to Day 4 blastocysts occurred for 4 hours in BMOC-3 medium and ap- pears consistent among treatment groups.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not analytically quantified.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and based on a previous study (Elliot et al 1974
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1, 10, and 100 micro-g per mL BMOC-3).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
rest organis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
	Metric 15:	Conditions Number of Organisms and	Low	The replicates were not well described. There were 10 blastocysts per well.
		Replicates per Group		
Domain 5: Outcome As	sessment			
20mmin 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Medium	Culture methods were referenced and described. Some housing details were provided for surrogate females; diet, size of cages, and the type of bedding were not described.
	Metric 17:	Outcome Assessment Methodology	High	The sex ratio of fetuses was determined along with the number of implantation sites in each uterine horn.
		Conti	nued on next pa	nge
			D 100 C 110	

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		continu	ied from previ	ous page		
Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and embry	onic developm	ent. Teratology 15(3):273-279.		
Duration:		ation: 11 - 21 days; Exposure Duration: 0 - 4	-			
Exposure Route,			• • •	nemical of interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; CD-1; Embryo					
Health Outcome:	Reproductive/Teratogenic					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	182					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology took place on day 18 of gestation.		
Domain 6: Confounding		ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no apparent differences in environmental conditions between the study groups.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported (Table 2), and there were no non-treatment differences between study groups that would influence the outcome assessment.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical analysis was performed and described in the footnote of Table 2.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 2.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Data was presented with standard error, and unexpected outcomes (apparent lack of difference in outcomes in treatments vs control group) were explained by authors in the discussion section.		
Additional Comments:	This portion fetuses.	of the study assessed the number of pregna	ant organisms,	the number of implants, the fetal sex ratio of the organisms, and the number o		

Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and emb	oryonic develo	opment. Teratology 15(3):273-279.
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 0	- 4 days (0-96	h)
Exposure Route,	Terrestrial; C	Cell Culture Media; Not determined by stu	dy authors (i.	e., chemical of interest in exposure water, but unable to determine exact uptake route
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mus musculus; CD-1; Embry	0	
Health Outcome:	Reproductiv	e/Teratogenic		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	182			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
2 chian 2. Toot Doorgii	Metric 4:	Negative Controls	High	A BMOC-3 medium control group was included.
	Metric 5:	Negative Control Response	Medium	The biological response of the control group was shown in Table 2. There were some
				malformations noted in the control group for day 4 recipients.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Cha			Ŧ	
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations in BMOC-3 medium.
	Metric 8:	Consistency of Exposure	High	The exposure to Day 4 blastocysts occurred for 4 hours in BMOC-3 medium and ap-
		Administration		pears consistent among treatment groups.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not analytically quantified.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure was reported and based on a previous study (Elliot et al 1974).
	Metric 11:	Number of Exposure Groups/	High	The study included a control and three asbestos concentrations (1, 10, and 100 micro-g
		Spacing of Exposure Levels	U	per mL BMOC-3).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organist	n			
is rost organisi	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
	Metric 15:	Conditions Number of Organisms and	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
	Methe 13.	Replicates per Group	LOW	The study are not report whether plastocysts were acclinialized pror to reautient.
Domain 5: Outcome Ass	essment			
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	Medium	The culture methods were referenced and described. Some housing details were pro-
	mente 10.	Adoquacy of Test Conditions	wiculuill	vided for surrogate females; diet, size of cages, and the type of bedding not described.
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was cited to other publications, but few details were provided.
		Cart	tinued on nex	4

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		contir	nued from p	previous page				
Study Citation:	Schneider, V	, Maurer, R. R. (1977). Asbestos and embi	ryonic devel	opment. Teratology 15(3):273-279.				
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 0 -	4 days (0-9	6h)				
Exposure Route,	Terrestrial; C	Cell Culture Media; Not determined by stud	y authors (i	e., chemical of interest in exposure water, but unable to determine exact uptake route)				
Media, Path:								
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; CD-1; Embryo							
Health Outcome:	Reproductive/Teratogenic							
Chemical:	chrysotile (se	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	182							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology was conducted on day 18 of gestation.				
Domain 6: Confounding	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 2), and there were no non-treatment differences between study groups that would influence the outcome assessment.				
Domain 7: Data Present	ation and Anal	ysis						
	Metric 21:	Statistical Methods	Low	The statistical analysis was not described adequately.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 2.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Authors reported the number of malformations for each group; data appeared more consistent across control and treatment groups.				
Additional Comments:	This portion	of the study assessed the percent of malfor	med fetuses	·				
Overall Qualit	ty Detern	nination	Low					

Study Citation:	Schneider. V	A., Maurer, R. R. (1977). Asbestos and embr	vonic developme	ent. Teratology 15(3):273-279.
Duration:		ation: 11 - 21 days; Exposure Duration: 0 -		
Exposure Route,				memical of interest in exposure water, but unable to determine exact uptake route
Media, Path:	· · · · · ,	,	, , .	
Taxa, Species, Age:	Vertebrate:]	Mammalian; Mus musculus; CD-1; Embryo		
Health Outcome:	Mortality			
Chemical:	2	erpentine) (CASRN 12001-29-5)		
HERO ID:	182			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ice			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	A BMOC-3 medium control group was included.
	Metric 5:	Negative Control Response	Medium	A high percentage of reabsorptions/dead organisms were observed in the control group likely due to the nature of the experimental set-up.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations in BMOC-3 medium.
	Metric 8:	Consistency of Exposure Administration	High	The exposure to Day 4 blastocysts occurred for 4 hours in BMOC-3 medium and ap- pears consistent among treatment groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not analytically quantified.
	Metric 10:	Exposure Duration and Frequency	High	The duration of the exposure was reported and based on a previous study (Elliot et al 1974).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1, 10, and 100 micro-g per mL BMOC-3).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	sm			
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
	Metric 15:	Conditions Number of Organisms and	Low	The number of replicates was not well described. There were 10 blastocysts per well.
		Replicates per Group		
Domain 5: Outcome As	sessment			
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Medium	Culture methods were referenced and described. Some housing details were provided for surrogate females; diet, size of cages, and the type of bedding were not described.
	Metric 17:	Outcome Assessment Methodology	Medium	It was not described how the fetuses were determined to be living.
	Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology took place on day 18 of gestation.
		Assessment		

Study Citation: Duration: Exposure Route,	Overall Dura	7., Maurer, R. R. (1977). Asbestos and embry ation: 11 - 21 days; Exposure Duration: 0 - 4 Cell Culture Media; Not determined by study	days (0-96h)	ent. Teratology 15(3):273-279. hemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; CD-1; Embryo						
Health Outcome:	Mortality						
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)					
HERO ID:	182						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	-		II: - h				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no apparent differences in environmental conditions between the study groups.			
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported (Table 2), and there were no non-treatment differences between study groups that would influence the outcome assessment.			
Domain 7: Data Present	tation and Anal	ysis					
	Metric 21:	Statistical Methods	High	The statistical analysis was described adequately in the text and in the footnote of Table 2.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 2.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Data was presented with standard error, and there were no unexpected outcomes.			

Medium

Study Citation:		A., Maurer, R. R. (1977). Asbestos and embr		ent. Teratology 15(3):273-279.					
Duration:		ation: 11 - 21 days; Exposure Duration: 0		nemical of interest in exposure water, but unable to determine exact uptake route					
Exposure Route, Media, Path:	Terrestriar; v	Len Culture Media, Not determined by stud	y authors (i.e., ci	iennear of interest in exposure water, but unable to determine exact uptake route					
	Vartabrata: 1	Mammalian: Mus musculus: CD 1: Embryo							
Taxa, Species, Age: Health Outcome:		Mammalian; <i>Mus musculus</i> ; CD-1; Embryo							
Chemical:	•	Development/Growth chrysotile (serpentine) (CASRN 12001-29-5)							
HERO ID:	182	erpentine) (CASKN 12001-29-3)							
	162								
Domain Domain 1: Test Substan		Metric	Rating	Comments					
Domain 1: Test Substan	Metric 1:	Test Substance Identity	Madium	The CASEN was not may ided but the elemential was referred to so No. 7DEO2					
		Test Substance Identity Test Substance Source	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2. The source was identified.					
	Metric 2: Metric 3:	Test Substance Purity	High						
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	A BMOC-3 medium control was included.					
	Metric 5:	Negative Control Response	High	The response of the control group was reported in Table 2 and appears reasonable.					
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.					
Domain 3: Exposure Cl									
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations in BMOC-3 medium.					
	Metric 8:	Consistency of Exposure Administration	High	The exposure to Day 4 blastocysts occurred for 4 hours in BMOC-3 medium and appears consistent among treatment groups.					
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not analytically quantified.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of the exposure was reported and based on a previous study (Elliot et al 1974).					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1, 10, and 100 micro-g per mL BMOC-3).					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis									
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported					
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether blastocysts were acclimatized prior to treatment.					
	Metric 15:	Conditions Number of Organisms and	Low	The number of replicates was not well described. There were 10 blastocysts per well.					
		Replicates per Group							
Domain 5: Outcome As	ssessment								
	Metric 16:	Adequacy of Test Conditions	Medium	Culture methods were referenced and described. Some housing details were provided for surrogate females; diet, size of cages, and the type of bedding were not described.					
	Metric 17:	Outcome Assessment Methodology	Medium	Live fetuses were weighed; the methodology did not describe criteria for determining stunted vs normal fetuses.					
	Metric 18:	Consistency of Outcome Assessment	High	Fetuses were weighed on day 18 of gestation.					
			nued on next pa						

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		continu	ied from previ	ous page		
Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and embry	onic developm	ent. Teratology 15(3):273-279.		
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 0 - 4	days (0-96h)			
Exposure Route,	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; CD-1; Embryo					
Health Outcome:	Development/Growth					
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	182					
Domain		Metric	Rating	Comments		
Domain 6: Confoundin	ng / Variable Con Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 2), and there were no non-treatment differences between		
		o alcomes e menalea lo Emposare	B			
				study groups that would influence the outcome assessment.		
Domain 7: Data Presen		ysis				
Domain 7: Data Presen		lysis Statistical Methods	Low			
Domain 7: Data Preser	ntation and Anal	5	Low High	study groups that would influence the outcome assessment.		

Medium

Study Citation:	Schneider, V	V., Maurer, R. R. (1977). Asbestos and emb	oryonic develo	opment. Teratology 15(3):273-279.
Duration:		ation: 0 - 4 days (0-96h); Exposure Duration		
Exposure Route,	Terrestrial;	Cell Culture Media; Not determined by stu	dy authors (i.	e., chemical of interest in exposure water, but unable to determine exact uptake route
Media, Path:			-	
Taxa, Species, Age:	Vertebrate;	Mammalian; Mus musculus; CD-1; Embry	D	
Health Outcome:	ADME (bio	transformation)		
Chemical:	chrysotile (s	serpentine) (CASRN 12001-29-5)		
HERO ID:	182			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	A BMOC-3 medium control group was included.
	Metric 5:	Negative Control Response	Low	No response was reported for the control group.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations in BMOC-3 medium.
	Metric 8:	Consistency of Exposure Administration	High	The exposure to Day 4 blastocysts occurred for 4 hours in BMOC-3 medium and ap- pears consistent among treatment groups.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not analytically quantified.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of the exposure was reported and based on a previous study (Elliot et al 1974).
	Metric 11:	Number of Exposure Groups/	N/A	There was a control group and one treatment group (100 microgram asbestos per mL).
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported.
	Metric 13: Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	The number of replicates was not well described. There were 10 blastocysts per well.
Domain 5: Outcome As	assmant			
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	High	Culture methods were referenced and described.
	Metric 10. Metric 17:	Outcome Assessment Methodology	High	Asbestos fiber presence was described in the methods.
	Metric 17: Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology took place after a 4 hour exposure.
			inued on nex	at page

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		conth	iueu iroin p	revious page			
Study Citation:		, Maurer, R. R. (1977). Asbestos and embr					
Duration:		ation: 0 - 4 days (0-96h); Exposure Duratio					
Exposure Route,	Terrestrial; C	Cell Culture Media; Not determined by stud	ly authors (1.	e., chemical of interest in exposure water, but unable to determine exact uptake route			
Media, Path:	X7 / 1 / X						
Taxa, Species, Age:		Vertebrate; Mammalian; <i>Mus musculus</i> ; CD-1; Embryo					
Health Outcome:	ADME (biotransformation)						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	182						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test	High	There were no apparent differences in environmental conditions between the study			
		Design and Procedures		groups.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information suggesting differences in blastocyst survival during the four hours.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	N/A	The study focused on qualitative analysis of asbestos fibers (location and presence).			
	Metric 22:	Reporting of Data	Low	Representative figures were shown in the text of the 100 microgram per mL treatment but not of the control group. Results were described in the text for the treated group but not the control group.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	No variability was reported.			
		~ ^					
Additional Comments:	This portion	of the study assessed the uptake of asbesto	s in blastocy	sts.			

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Study Citation:				os fibers detected in the newborn pups following gavage feeding of pregnant mice
		oxicology and Environmental Health, Part A		62(1):23-31.
Duration:		ation: > 21 days; Exposure Duration: 11 - 2	21 days	
Exposure Route,	Terrestrial; 1	N/A (e.g., injection); Dietary		
Media, Path:				
Taxa, Species, Age:		Mammalian; Mus musculus; ICR; Adult		
Health Outcome:	· ·	transformation)		
Chemical:	-	serpentine) (CASRN 12001-29-5)		
HERO ID:	758926			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source was stated.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.
Domain 2: Test Design				
Domain 2. Test Design	Metric 4:	Negative Controls	High	The study contained a control group (saline gavage).
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for
	Weute 5.	Regarive Control Response	Ingn	the assessed outcomes. No fibers were found in controls pups.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media	Medium	A suspension was used, but few details were provided.
		Preparation		
	Metric 8:	Consistency of Exposure	Medium	Two doses were administered on days 2 and 4 after acclimation. Two days after day 4,
		Administration		mice were mated and upon confirmed pregnancy, mice were dosed on gestational days and 12. Authors did not report the number of days between the first females becoming
				pregnant and the last females becoming pregnant (presumably gestational days 7 and 1)
				differed female to female).
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
		Concentration		1
	Metric 10:	Exposure Duration and Frequency	Medium	Exposure occurred twice before pregnancy, and then on days 7 and 12 of pregnancy.
				Total exposure time would slightly differ among female mice depending on when preg-
	Metric 11:	Number of Exposure Groups/	N/A	nancy occurred. One concentration was used.
	Metric 11:	Spacing of Exposure Groups/	1N/A	One concentration was used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (gavage).
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	High	The test organisms were described as female ICR mice and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions.
		Conditions		
		Conti	nued on next pa	ge

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		conti	nued from previo	us page			
Study Citation:	Haque, A. K., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chrysotile asbestos fibers detected in the newborn pups following gavage feeding of pregnant mice. Journal of Toxicology and Environmental Health, Part A: Current Issues 62(1):23-31. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days						
Duration:							
Exposure Route,		V/A (e.g., injection); Dietary	21 days				
Media, Path:	Torrosinal, TVTT (e.g., mjocaton), Diotary						
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; ICR; Adult						
Health Outcome:	ADME (biotransformation)						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	758926						
Domain		Metric	Rating	Comments			
	Metric 15:	Number of Organisms and Replicates per Group	Medium	Six female mice were treated and 6 were control. Litters were obtained from each mouse.			
		Replicates per Gloup					
Domain 5: Outcome As							
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	High	The methodology for electron microscopy was well described.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
Domain 6: Confounding	/ Variable Co	ntrol					
2 onian of confounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures		conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Low	Statistical methods for treated pups was described but there was no alpha stated.			
	Metric 22:	Reporting of Data	High	Mean fiber count in the lung and liver of treated pups was shown in Figure 1. It was also discussed in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	The study reported variability among litters but not within litters.			
Additional Comments:	None						
		•					
Overall Qualit	ty Detern	nination	Medium				

verall Dura rrestrial; N rtebrate; M evelopment rysotile (se 8926 etric 1: etric 2: etric 2: etric 3:	xicology and Environmental Health, Part A tion: > 21 days; Exposure Duration: 11 - 2 //A (e.g., injection); Dietary fammalian; <i>Mus musculus</i> ; ICR; Adult //Growth erpentine) (CASRN 12001-29-5) <u>Metric</u> Test Substance Identity Test Substance Source Test Substance Purity	1 days Rating Low High	Comments The chemical was identified by name only.
rtebrate; M evelopment rysotile (se 8926 etric 1: etric 2: etric 2: etric 3:	Iammalian; <i>Mus musculus</i> ; ICR; Adult /Growth prpentine) (CASRN 12001-29-5) Metric Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
evelopment rysotile (se 8926 etric 1: etric 2: etric 2: etric 3:	/Growth erpentine) (CASRN 12001-29-5) Metric Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
evelopment rysotile (se 8926 etric 1: etric 2: etric 2: etric 3:	/Growth erpentine) (CASRN 12001-29-5) Metric Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
etric 1: etric 2: etric 3: etric 4:	Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
etric 1: etric 2: etric 3: etric 4:	Metric Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
etric 1: etric 2: etric 3: etric 4:	Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
etric 2: etric 3: etric 4:	Test Substance Identity Test Substance Source	Low High	The chemical was identified by name only.
etric 2: etric 3: etric 4:	Test Substance Source	High	
etric 2: etric 3: etric 4:	Test Substance Source	High	
etric 3: etric 4:		-	The source was reported
etric 4:	Test Substance Purity	τ	The source was reported.
		Low	Purity and/or grade of test substance were not reported.
	Negative Controls	High	Study contained a control group (saline gavage).
etric 5:	Negative Control Response	High	Mean weight gain of pups is shown in Figure 2 and described in the text.
etric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
terization			
etric 7:	Experimental System/Test Media Preparation	Medium	A suspension was used but few details were provided.
etric 8:	Consistency of Exposure Administration	Medium	Two doses were administered on days 2 and 4 after acclimation. Two days after day 4, mice were mated and upon confirmed pregnancy, mice were dosed on gestational days and 12. Authors did not report the number of days between the first females becoming pregnant and the last females becoming pregnant (presumably gestational days 7 and 12 differed female to female).
etric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
etric 10:	Concentration Exposure Duration and Frequency	Medium	Exposure occurred twice before pregnancy and then on days 7 and 12 of pregnancy. Total exposure time would slightly differ among female mice depending on when preg- nancy occurred.
etric 11:	Number of Exposure Groups/	N/A	Only one concentration was used.
etric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (gavage).
etric 13:	Test Organism Characteristics	High	The test organisms were described as female ICR mice and were obtained from a reliable source.
etric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions.
etric 15:	Number of Organisms and	Medium	Six female mice were treated and 6 were control. Litters were obtained from each mouse.
	tric 8: tric 9: tric 10: tric 11: tric 12: tric 13: tric 14:	tric 7:Experimental System/Test Media Preparation Consistency of Exposure Administrationtric 8:Consistency of Exposure Administrationtric 9:Measurement of Test Substance Concentration tric 10:tric 10:Exposure Duration and Frequencytric 11:Number of Exposure Groups/ Spacing of Exposure Levels tric 12:tric 12:Test Organism Characteristicstric 13:Test Organism Characteristicstric 14:Acclimatization and Pretreatment Conditions	tric 7:Experimental System/Test MediaMediumPreparationPreparationMediumtric 8:Consistency of ExposureMediumAdministrationAdministrationMediumtric 9:Measurement of Test SubstanceLowconcentrationConcentrationMediumtric 10:Exposure Duration and FrequencyMediumtric 11:Number of Exposure Groups/N/Aspacing of Exposure LevelsN/Atric 12:Test Organism CharacteristicsHightric 13:Test Organism CharacteristicsHightric 14:Acclimatization and PretreatmentHightric 15:Number of Organisms andMedium

Domain 5: Outcome Assessment

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Study Citation:	Haque, A. K., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chrysotile asbestos fibers detected in the newborn pups following gavage feeding of pregnant mice.							
	Journal of Toxicology and Environmental Health, Part A: Current Issues 62(1):23-31.							
Duration:	Overall Duration: > 21 days; Exposure Duration: 11 - 21 days							
Exposure Route,	Terrestrial; N/A (e.g., injection); Dietary							
Media, Path:	Vertahrata: Mammalian: Muc mucculus: ICP: Adult							
Taxa, Species, Age: Health Outcome:	Vertebrate; Mammalian; <i>Mus musculus</i> ; ICR; Adult							
Chemical:	Development/Growth chrysotile (serpentine) (CASRN 12001-29-5)							
HERO ID:	758926	erpentine) (CASKIV 12001-29-3)						
Domain		Metric	Rating	Comments				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.				
	Metric 17:	Outcome Assessment Methodology	Medium	Weight gain was determined from subtracting birth weight from weight at time of sacri fice. Actual weights were not reported.				
	Metric 18:	Consistency of Outcome Assessment	Medium	Pups from both treated and control litters were weighed on days 8, 11, 19, and 20 after birth (some differences remained between control and treated in the number of litters sacrificed on a given day).				
	1.11.0	<i>.</i>						
Domain 6: Confounding	·		Low					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.				
Domain 7: Data Presenta	ation and Anal	lysis						
	Metric 21:	Statistical Methods	Low	The test utilized was described but alpha was not stated.				
	Metric 22:	Reporting of Data	High	Mean weight gain was presented for each treatment and control group in Figure 2.				
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals and/or insufficient information was provided to determine if excessive variability or unexpected outcomes occurred.				
	None							

Study Citation:		L., Ali, I., Vrazel, D. M., Uchida, T. (2001). oxicology and Environmental Health, Part		sbestos fibers detected in the newborn pups following gavage feeding of pregnant n sues 62(1):23-31.					
Duration:		ation: > 21 days; Exposure Duration: 11 -							
Exposure Route,	Terrestrial; 1	N/A (e.g., injection); Dietary							
Media, Path:									
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; ICR; Adult								
Health Outcome:	Mortality								
Chemical:	-	serpentine) (CASRN 12001-29-5)							
HERO ID:	758926								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The source was stated.					
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
C C	Metric 4:	Negative Controls	High	The study contained a control group (saline gavage).					
	Metric 5:	Negative Control Response	Medium	Biological response of the control was stated in the text as total number. It is unclear if					
		_		the deaths occurred in a single litter versus multiple.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	aracterization								
	Metric 7:	Experimental System/Test Media	Medium	A suspension was used but few details were provided.					
		Preparation							
	Metric 8:	Consistency of Exposure Administration	Medium	Two doses were administered on days 2 and 4 after acclimation. Two days after day 4, mice were mated and upon confirmed pregnancy, mice were dosed on gestational days 7 and 12. Authors did not report the number of days between the first females becoming pregnant and the last females becoming pregnant (presumably gestational days 7 and 12 differed female to female).					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
		Concentration							
	Metric 10:	Exposure Duration and Frequency	Medium	Exposure occurred twice before pregnancy and then on days 7 and 12 of pregnancy. Total exposure time would slightly differ among female mice depending on when preg- nancy occurred.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	One concentration was used.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (gavage).					
Domain 4: Test Organis	m								
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were described as female ICR mice and were obtained from a reli- able source.					
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions.					
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	Six female mice were treated and 6 were control. Litters were obtained from each mouse.					

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Overall Quali	ty Detern	nination	Low				
Additional Comments:	None						
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Variability is not necessarily applicable for reporting total number of dead pups.			
	Metric 22:	Reporting of Data	Low	The total number of dead pups was presented for control and treatment. It is unclear as to when they died or from how many litters there were.			
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
Domain 7: Data Present		•	TT: 1				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
Domain 6: Confounding	-		-				
		Assessment					
	Metric 18:	Consistency of Outcome	Medium	It is unclear if counts were made daily.			
	Metric 17:	Outcome Assessment Methodology	High	Non-sacrifice death of pups was recorded.			
2 chian 27 Guteonie 715	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
Domain 5: Outcome As	sessment	wieute	Kating	Comments			
Domain		Metric	Rating	Comments			
HERO ID:	758926						
Chemical:	2	erpentine) (CASRN 12001-29-5)					
Taxa, Species, Age: Health Outcome:	Mortality	Mammalian; Mus musculus; ICR; Adult					
Media, Path:	Vantahuata. N	Ammelian Museumanlus ICD. Adult					
Exposure Route,	Terrestrial; N	N/A (e.g., injection); Dietary					
Duration:		ation: > 21 days; Exposure Duration: 11 -	21 days				
oudy crownond	Journal of Toxicology and Environmental Health, Part A: Current Issues 62(1):23-31.						
Study Citation:	Haque, A. K., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chrysotile asbestos fibers detected in the newborn pups following gavage feeding of pregnant mice.						

Study Citation:	-	., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chroxicology and Environmental Health, Part A: C	-	s detected in the newborn pups following gavage feeding of pregnant mice.
Duration: Exposure Route,	Overall Dura	ation: > 21 days; Exposure Duration: 11 - 21 d V/A (e.g., injection); Dietary		5-51.
Media, Path:	Vartabrata: N	Mommolion, Mus musculus, ICD, Adult		
Faxa, Species, Age: Health Outcome:		Mammalian; <i>Mus musculus</i> ; ICR; Adult e/Teratogenic		
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	758926			
Domain		Metric	Rating	Comments
Domain 1: Test Substan			_	
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source was reported.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	The study contained a control group (saline gavage).
	Metric 5:	Negative Control Response	Medium	Average litter size was reported in the text for the control group. No variance was reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 2: Exposure Ch	oractorization			
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	A suspension was used, but few details were provided.
	Wette 7.	Preparation	Wiedrum	A suspension was used, but iew details were provided.
	Metric 8:	Consistency of Exposure Administration	Medium	Two doses were administered on days 2 and 4 after acclimation. Two days after day 4, mice were mated and upon confirmed pregnancy, mice were dosed on gestational days and 12. Authors did not report the number of days between the first females becoming pregnant and the last females becoming pregnant (presumably gestational days 7 and 1 differed female to female).
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	Medium	Exposure occurred twice before pregnancy and then on days 7 and 12 of pregnancy. Total exposure time would slightly differ among female mice depending on when preg- nancy occurred.
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was used.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet (gavage).
Domain 4: Test Organis	m			
Comun 1. rest Organis.	Metric 13:	Test Organism Characteristics	High	The test organisms were described as female ICR mice and were obtained from a reli- able source.
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized to test conditions.
	Metric 15:	Conditions Number of Organisms and	Medium	Six female mice were treated and 6 were control. Litters were obtained from each
		Replicates per Group		mouse.

			continued from previous pa	ge			
Study Citation:	Haque, A. K., Ali, I., Vrazel, D. M., Uchida, T. (2001). Chrysotile asbestos fibers detected in the newborn pups following gavage feeding of pregnant mice.						
Destin		oxicology and Environmental Health, Part A					
Duration:		ation: > 21 days; Exposure Duration: 11 - 2	21 days				
Exposure Route,	Terrestrial; N/A (e.g., injection); Dietary						
Media, Path:	Vertebrate; Mammalian; Mus musculus; ICR; Adult						
Taxa, Species, Age: Health Outcome:	· · ·						
Chemical:	•	e/Teratogenic					
HERO ID:	758926	erpentine) (CASRN 12001-29-5)					
	738920						
Domain		Metric	Rating	Comments			
Domain 5: Outcome As							
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	High	Litter size was determined per female and averaged within treatment groups.			
	Metric 18:	Consistency of Outcome	Medium	Litter size was presumably determined at time of birth.			
		Assessment					
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.			
	Metric 22:	Reporting of Data	Medium	Average litter size for treated and control was stated in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals)			
				and/or insufficient information was provided to determine if excessive variability or unexpected outcomes occurred.			
Additional Comments:	None						
Overall Quali	ty Deterr	nination	Uninformative				

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Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	⁷ ., Maurer, R. R. (1977). Asbestos and embryation: 11 - 21 days; Exposure Duration: 11 - 2 Vater; Dietary		ent. Teratology 15(3):273-279.
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Developmen	Mammalian; <i>Mus musculus</i> ; CD-1; Embryo t/Growth erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substance	e			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	A water-only group was included.
	Metric 5:	Negative Control Response	High	The response of the control group was shown in Table 1 and appears reasonable.
	Metric 6:	Randomized Allocation	Medium	Female mice were randomly distributed.
Domain 3: Exposure Cha	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	Medium	Preparation of the stock solution was described, and the water solution was renewed daily. It is unclear if treatment concentrations were prepared straight from the stock solution or if they were serially diluted.
	Metric 8:	Consistency of Exposure Administration	Medium	Treatments were administered daily in the drinking water and concluded on day 15 of pregnancy; however, it is unclear when dosing commenced (on day 1 vs prior to day 1).
	Metric 9:	Measurement of Test Substance Concentration	Medium	Asbestos was weighed and water consumption was measured, but no analytical quantitation was described.
	Metric 10:	Exposure Duration and Frequency	Medium	It was unclear if they exposure commenced prior to pregnancy. If it commenced on day 1 of pregnancy, the exposure would be 15 days, and this seems appropriate.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1.43, 14.3, and 143 micro-g per L water).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisr	n			
C C	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of female mice per group (10-12) and replicate groups per treatment (three replicate groups) were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Ass	essment			
	Metric 16:	Adequacy of Test Conditions	Medium	Some housing details were provided; diet, size of cages, and type of bedding not were described.
		Contin	ued on next pa	ge

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		contin	ued from previ	ous page			
Study Citation:	Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.						
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,	Terrestrial; V	Water; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mus musculus; CD-1; Embryo					
Health Outcome:	Developmen	nt/Growth					
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	182						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	Medium	Live fetuses were weighed; the methodology does not describe criteria for determining stunted vs normal fetus.			
	Metric 18:	Consistency of Outcome	High	Fetuses were weighed on day 18 of gestation.			
		Assessment					
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no apparent differences in environmental conditions between the study groups.			
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported (Table 1), and there were no non-treatment differences between study groups that would influence the outcome assessment.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Low	Statistical analysis was not described adequately.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 1.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Lack of significance from the control group was discussed by the authors in the Discus- sion. Data was presented with standard error.			
Additional Comments:	This portion	of the study assessed fetal weight and the pe	ercent of stunted	organisms.			
Overall Quali	ty Deterr	nination	Medium				

Study Citation: Duration: Exposure Route,	Overall Dura	7, Maurer, R. R. (1977). Asbestos and emb ation: 11 - 21 days; Exposure Duration: 11 Vater; Dietary		opment. Teratology 15(3):273-279.
Media, Path:				
Taxa, Species, Age:		Mammalian; Mus musculus; CD-1; Embry	0	
Health Outcome: Chemical:		e/Teratogenic erpentine) (CASRN 12001-29-5)		
HERO ID:	182	(CASKIV 12001-29-3)		
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	A water-only control was included.
	Metric 5:	Negative Control Response	Medium	The response of the control group was shown in Table 1; a higher number of malforma- tions was shown in the control group than in other treatment groups, but there were also more live fetuses in the control group than in other treatment groups.
	Metric 6:	Randomized Allocation	Medium	The female mice were randomly allocated.
	, . , .			
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	Descention of the stack solution was described and the water solution was renewed
	Meure 7.	Preparation	Medium	Preparation of the stock solution was described, and the water solution was renewed daily. It was unclear if treatment concentrations were prepared straight from stock the solution or if they were serially diluted.
	Metric 8:	Consistency of Exposure Administration	Medium	Treatments were administered daily in the drinking water and were concluded on day 15 of pregnancy; however, it is unclear when dosing commenced (on day 1 vs prior to day 1).
	Metric 9:	Measurement of Test Substance Concentration	Medium	Asbestos was weighed and water consumption was measured, but no analytical quantita- tion was described.
	Metric 10:	Exposure Duration and Frequency	High	It was unclear if the exposure commenced prior to pregnancy. If the exposure com- menced on day 1 of pregnancy, the exposure would be 15 days, and this seems appropri- ate.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1.43, 14.3, and 143 micro-g per L water).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisi	m			
Domain 4. Test Organisi	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported.
	Metric 13: Metric 14:	Acclimatization and Pretreatment	Low	The test organisms were adequately described, but the original source was not reported. The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of female mice per group (10-12) and replicate groups per treatment (three replicate groups) were reported and sufficient to characterize toxicological effects.

Domain 5: Outcome Assessment

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Study Citation:	,	, Maurer, R. R. (1977). Asbestos and embr	2	opment. Teratology 15(3):273-279.		
Duration:		ation: 11 - 21 days; Exposure Duration: 11	- 21 days			
Exposure Route,	Terrestrial; V	Vater; Dietary				
Media, Path:						
Taxa, Species, Age:		Aammalian; Mus musculus; CD-1; Embryo				
Health Outcome:	Reproductive/Teratogenic					
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	182					
Domain		Metric	Rating	Comments		
	Metric 16:	Adequacy of Test Conditions	Medium	Some housing details were provided; diet, size of cages, and type of bedding were not described.		
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was cited to other publications, but few details were provided.		
	Metric 18:	Consistency of Outcome	High	The outcome methodology was conducted on Day 18 of gestation.		
		Assessment				
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	High	There were no apparent differences in environmental conditions between the study		
		Design and Procedures		groups.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported (Table 1), and there were no non-treatment differences between study groups that would influence the outcome assessment.		
Domain 7: Data Presenta	ation and Anal	vsis				
	Metric 21:	Statistical Methods	Low	Statistical analysis was not described adequately.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 1.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Authors did not discuss why higher numbers of malformations were observed in the control group vs the chrysotile treatments.		
Additional Comments:	This portion	of the study assessed the percent of malfor	med organis	ms.		
Overall Auglit	v Dotorn	nination	Low			
Overall Qualit	y Detern	nination	Low			

Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and embr	yonic developme	ent. Teratology 15(3):273-279.
Duration:	Overall Dura	ation: 11 - 21 days; Exposure Duration: 11 -	- 21 days	
Exposure Route,	Terrestrial; V	Water; Dietary		
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mus musculus; CD-1; Embryo		
Health Outcome:	Reproductiv	re/Teratogenic		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	182	•		
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was referred to as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
Domani 2. Test Design	Metric 4:	Negative Controls	High	A water-only control was included.
	Metric 5:	Negative Control Response	High	The response of the control group was shown in Table 1 and appears reasonable.
	Metric 6:	Randomized Allocation	Medium	Female mice were randomly distributed.
Domain 3: Exposure Ch				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The preparation of the stock solution was described, and the water was renewed daily. I was unclear if treatment concentrations were prepared straight from the stock solution of were serially diluted.
	Metric 8:	Consistency of Exposure Administration	Medium	Treatments were administered daily in the drinking water and concluded on day 15 of pregnancy; however, it is unclear when dosing commenced (on day 1 vs prior to day 1).
	Metric 9:	Measurement of Test Substance	Medium	Asbestos was weighed and water consumption was measured, but no analytical quantita tion was described.
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	It was unclear if the exposure commenced prior to pregnancy. If it commenced on day 1
	Metric 11:	Number of Exposure Groups/	High	of pregnancy, the exposure would be 15 days, and this seemed appropriate. The study included a control and three asbestos concentrations (1.43, 14.3, and 143
		Spacing of Exposure Levels		micro-g per L water).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis	m			
-	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of female mice per group (10-12) and replicate groups per treatment (three replicate groups) were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Ass	sessment			
20man 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Medium	Some housing details were provided; diet, size of cages, and the type of bedding were not described.
	Metric 17:	Outcome Assessment Methodology	High	The sex ratio of the fetuses along with the number of implantation sites in each uterine horn were determined.

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		continu	ed from previ	ous page			
Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and embry	onic developm	ent. Teratology 15(3):273-279.			
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,	Terrestrial; Water; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Mus musculus; CD-1; Embryo					
Health Outcome:	Reproductive	e/Teratogenic					
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)					
HERO ID:	182						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	The outcome methodology was conducted on Day 18 of gestation.			
	Methe 10.		8				
	Methe 10.	Assessment	8				
		Assessment					
Domain 6: Confoundin	g / Variable Co	Assessment	_				
Domain 6: Confoundin		Assessment ntrol Confounding Variables in Test	High	There were no apparent differences in environmental conditions between the study			
Domain 6: Confoundin	g / Variable Cor Metric 19:	Assessment ntrol Confounding Variables in Test Design and Procedures	High	There were no apparent differences in environmental conditions between the study groups.			
Domain 6: Confoundin	g / Variable Co	Assessment ntrol Confounding Variables in Test	_	There were no apparent differences in environmental conditions between the study			
	g / Variable Con Metric 19: Metric 20:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 1), and there were no non-treatment differences between			
Domain 6: Confoundin Domain 7: Data Presen	g / Variable Con Metric 19: Metric 20:	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 1), and there were no non-treatment differences between			
	g / Variable Con Metric 19: Metric 20: tation and Anal	Assessment ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	High High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 1), and there were no non-treatment differences between study groups that would influence the outcome assessment.			

Medium

Study Citation:	Schneider, V	., Maurer, R. R. (1977). Asbestos and embry	vonic developme	ent. Teratology 15(3):273-279.
Duration:		ation: 11 - 21 days; Exposure Duration: 11 -	, I	
Exposure Route,		Water; Dietary	,.	
Media, Path:	10110501100,			
Taxa, Species, Age:	Vertebrate: M	Mammalian; <i>Mus musculus</i> ; CD-1; Embryo		
Health Outcome:	Mortality			
Chemical:	2	erpentine) (CASRN 12001-29-5)		
HERO ID:	182			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Medium	The CASRN was not provided, but the chrysotile was described as No. 7RFO2.
	Metric 2:	Test Substance Source	High	The source was identified.
	Metric 3:	Test Substance Purity	Low	The purity and/or grade of the test substance were not reported.
Domain 2: Test Design				
Domain 2. Test Design	Metric 4:	Negative Controls	High	A water-only control was included.
	Metric 5:	Negative Control Response	High	The response of the control group was reported in Table 1 and appears reasonable.
	Metric 5:	Randomized Allocation	Medium	Female mice were randomly distributed.
	Methe 0.	Kandoniized Anocation	Wedlulli	remaie nice were randonny distributed.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media	Medium	Preparation of the stock solution was described, and the water solution was renewed
		Preparation		daily. It was unclear if treatment concentrations were prepared straight from the stock solution or if they were serially diluted.
	Metric 8:	Consistency of Exposure Administration	Medium	Treatments were administered daily in the drinking water and concluded on day 15 of pregnancy; however, it is unclear when dosing commenced (on day 1 vs prior to day 1).
	Metric 9:	Measurement of Test Substance Concentration	Medium	Asbestos was weighed and water consumption was measured, but no analytical quantita tion was described.
	Metric 10:	Exposure Duration and Frequency	Medium	It was unclear if the exposure commenced prior to pregnancy. If it commenced on day 1 of pregnancy, the exposure would be 15 days, and this seemed appropriate.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The study included a control and three asbestos concentrations (1.43, 14.3, and 143 micro-g per L water).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organis				
Domain 4. Test Olganis	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the original source was not reported.
	Metric 13. Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Meule 14:	Conditions	LOW	The study and not report whether test organisms were acclimatized.
	Metric 15:	Number of Organisms and	Medium	The numbers of female mice per group (10-12) and replicate groups per treatment (thre
		Replicates per Group		replicate groups) were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome As				
	Metric 16:	Adequacy of Test Conditions	Medium	Some housing details were provided; diet, size of cages, and type of bedding were not described.
	Metric 17:	Outcome Assessment Methodology	Medium	The methods for determining if the fetuses were living were not described
	Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology took place on Day 18 of gestation.

		continu	ued from previ	ious page			
Study Citation:		Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.					
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,	Terrestrial; V	Terrestrial; Water; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Mus musculus; CD-1; Embryo					
Health Outcome:	Mortality						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)					
HERO ID:	182						
Domain		Metric	Rating	Comments			
	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High High	There were no apparent differences in environmental conditions between the study groups. Attrition was reported (Table 1), and there were no non-treatment differences between study groups that would influence the outcome assessment.			
Domain 7: Data Presen	tation and Anal	ysis					
	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 1.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Data was presented with standard error, and unexpected outcomes (apparent lack of mortality in treatments vs control group) were explained by the authors in the discussion section.			
Additional Comments:	This form ap	pplies to percent resorptions and the number of	of dead fetuses.				
Overall Quali	ty Deterr	nination	Medium				

Study Citation:			Craighead, J. E., Richards, S. A., Calore, J. D., Fan, H., Weaver, D. L. (1993). Genetic factors influence malignant mesothelioma development in mice. European Respiratory Review, vol. 3, review no. 11 :118-120.					
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 d						
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection							
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; C3H(He), DBA/2, Balb/c Bailey, Balb/c Cumberland; Not Applicable (e.g., fungi or algae studies) or Not Reported							
Health Outcome:	Mortality crocidolite (riebeckite) (CASRN 12001-28-4)							
Chemical:		riebeckite) (CASRN 12001-28-4)						
HERO ID:	6867451							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan								
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the crocidolite was not reported.				
	Metric 3:	Test Substance Purity	Medium	The crocidolite was described as UICC, so it was held to a certain standard.				
Domain 2: Test Design								
C	Metric 4:	Negative Controls	Uninformative	The study authors did not report the use of a negative control. A positive control using 3-methycholanthrene was reported.				
	Metric 5:	Negative Control Response	Low	There was no negative control, and thus a negative control response was not reported.				
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the mice were allocated into study groups.				
Domain 2. Evenaguna Ch	anastanization							
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	The crocidolite was prepared in Hank's solution, and 10mg was injected intraperi-				
	Wietrie 7.	Preparation	Wiedrum	toneally into each mouse.				
	Metric 8:	Consistency of Exposure	Low	Exposures were administered via injection into the peritoneal cavity. Ten milligrams				
		Administration		of crocidolite was administered to each mouse. It was unclear how much solution was injected.				
	Metric 9:	Measurement of Test Substance	Low	It was not reported if the crocidolite was measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	Exposure was for the lifetime of the mouse or until the mouse developed illness or as- cites.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of this study was not to have a dose dependent response, but to observe re- sponses of genetically different mice to exposure to crocidolite.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Crocidolite is an insoluble chemical.				
Domain 4: Test Organis								
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source				
	Weute 15.		mgn	The mice used were all young females. The C3H and the DBA/2 strains came from Jackson Laboratories in Bar Harbor, ME, and the Balb/c Bailey and the Balb/c Cumber land were from the University of Vermont.				
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported if the mice were acclimated to testing conditions.				
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	The number of test organisms in each treatment was not reported.				
		<u> </u>	ontinued on next page .					

Study Citation:	Craighead I	E Richards S A Calore I D Fan H	Weaver D L (1993) (Genetic factors influence malignant mesothelioma development in mice.				
orady charlon		European Respiratory Review, vol. 3, review no. 11:118-120.						
Duration:		ation: > 21 days; Exposure Duration: > 21 da						
Exposure Route,	Terrestrial; N	V/A (e.g., injection); Injection						
Media, Path:								
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Mus musculus</i> ; C3H(He), DBA/2, Balb/c Bailey, Balb/c Cumberland; Not Applicable (e.g., fungi or algae studies) or Not Reported							
Health Outcome:	Mortality							
Chemical: HERO ID:	crocidolite (riebeckite) (CASRN 12001-28-4) 6867451							
Domain	0007451	Metric	Rating	Comments				
2000			Tuning					
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	Low	The test conditions and environment were not sufficiently reported to evaluate if they were adequate. It was not reported what the mice were fed for the duration of the study				
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was unclear on mortality observations or if dear mice were removed from the cage. Mice were observed twice weekly for illness or ascites. If illness or ascites was observed, mice were removed and examined for tumor				
	Metric 18:	Consistency of Outcome Assessment	Low	It was unclear how often mice were monitored for mortality. Mice were monitored twi weekly for illness or ascites.				
Domain 6: Confounding	/Variable Co	ntrol						
Domain 0. Comountuing	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
	Wiettie 17.	Design and Procedures	Low	conditions. It was not reported if the mice were acclimated to study conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Present	ation and Anal	veis						
Domain 7. Data i resent	Metric 21:	Statistical Methods	Uninformative	It did not appear that statistical analysis was conducted on mortality.				
	Metric 22:	Reporting of Data	Medium	There was not data for negative control survival, but there was no reported negative control. All other mortality data was presented.				
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.				
Additional Comments:	This study was to observe if genetic factors had any influence on the development of malignant mesothelioma in mice. The study primarily looked at cancer development, but also reported mortality. This evaluation was done on the mortality data presented. The study authors did not report the use of a negative							
Additional Comments:	This study w development	as to observe if genetic factors had any influer	nce on the development of was done on the mortal	The study did not report any measures of variability. of malignant mesothelioma in mice. The study primarily looked at cancer ity data presented. The study authors did not report the use of a negative				

Uninformative

Study Citation: Duration: Exposure Route, Media, Path:	Craighead, J. E., Richards, S. A., Calore, J. D., Fan, H., Weaver, D. L. (1993). Genetic factors influence malignant mesothelioma development in mice. European Respiratory Review, vol. 3, review no. 11 :118-120. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; N/A (e.g., injection); Injection						
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Cancer/Carc	Vertebrate; Mammalian; <i>Mus musculus</i> ; C3H(He), DBA/2, Balb/c Bailey, Balb/c Cumberland; Not Applicable (e.g., fungi or algae studies) or Not Reported Cancer/Carcinogenesis crocidolite (riebeckite) (CASRN 12001-28-4) 6867451					
Domain		Metric	Rating	Comments			
Domain 1: Test Substan							
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.			
	Metric 2:	Test Substance Source	Low	The source of the crocidolite was not reported.			
	Metric 3:	Test Substance Purity	Medium	The crocidolite was described as UICC, so it was held to a certain standard.			
Domain 2: Test Design							
	Metric 4:	Negative Controls	Uninformative	The study authors did not report the use of a negative control. A positive control using 3-methycholanthrene was reported.			
	Metric 5:	Negative Control Response	Low	There was no negative control, and thus a negative control response was not reported.			
	Metric 6:	Randomized Allocation	Low	The study authors did not report how the mice were allocated into study groups.			
Domain 3: Exposure Ch	aracterization						
Domain 5. Exposure er	Metric 7:	Experimental System/Test Media Preparation	Medium	The crocidolite was prepared in Hank's solution (not described), and 10mg was injected intraperitoneally into each mouse. The amount injected was not described.			
	Metric 8:	Consistency of Exposure Administration	Low	Exposures were administered via injection into the peritoneal cavity. Ten milligrams of crocidolite was administered to each mouse. The volume injected was not described.			
	Metric 9:	Measurement of Test Substance	Low	It was not reported if the crocidolite was measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	High	Exposure was for the lifetime of the mouse or until the mouse developed illness or as- cites.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of this study was not to have a dose dependent response, but to observe re- sponses of genetically different mice to exposure to crocidolite.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Crocidolite is an insoluble chemical.			
Domain 4. Test Organia							
Domain 4: Test Organis	m Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source. The mice used were all young females. The C3H and the DBA/2 strains came from Jackson Laboratories in Bar Harbor, ME, and the Balb/c Bailey and the Balb/c Cumber- land were from the University of Vermont.			
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported if the mice were acclimated to testing conditions.			
	Metric 15:	Number of Organisms and Replicates per Group	Low	The number of test organisms in each treatment was not reported.			
Domain 5: Outcome As	sessment						
			ontinued on next page .				

Study Citation:	Craighead, J	. E., Richards, S. A., Calore, J. D., Fan, H., W	Veaver, D. L. (1993).	Genetic factors influence malignant mesothelioma development in mice.			
Duration:	European Re Overall Dura	European Respiratory Review, vol. 3, review no. 11 :118-120. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial: N/A (e.g., injection): Injection					
Exposure Route, Media, Path:	Terrestrial; N	Terrestrial; N/A (e.g., injection); Injection					
Taxa, Species, Age:	Vertebrate; Mammalian; Mus musculus; C3H(He), DBA/2, Balb/c Bailey, Balb/c Cumberland; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome: Chemical:	Cancer/Carcinogenesis crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	6867451	(CASKN 12001-28-4)					
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	Low	The test conditions and environment were not sufficiently reported to evaluate if they were adequate. It was not reported what the mice were fed for the duration of the study.			
	Metric 17:	Outcome Assessment Methodology	Medium	Minimal detail was provided on the methodology for use of monoclonal antibodies to identify cytokeratin's as a marker for malignant mesothelioma (reagents, materials, and instrumentation not described). There was minimal description of methodology for use of other markers for determining epithelial tumors (reagents, materials, and instrumentation not described).			
	Metric 18:	Consistency of Outcome Assessment	Medium	All mice were assessed twice weekly for illness and ascites. If either of those conditions were observed, the mouse was euthanized and examined for tumors. Cytokeratin in fibroblastoid cells was used as the criterion for identifying malignant mesothelioma.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported if the mice were acclimated to study conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	tation and Anal	ysis					
	Metric 21:	Statistical Methods	N/A	This portion of the study focused on pathological findings and thus statistical analysis was not conducted.			
	Metric 22:	Reporting of Data	Medium	There was not data for negative control survival, but there was no reported negative control. Data for malignant mesothelioma can be found in Table 2 and Table 4, which also contains positive control data.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability was not reported.			
Additional Comments:	development	t, but also reported mortality. This evaluation w	as done on the devel	t of malignant mesothelioma in mice. The study primarily looked at cancer lopment of malignant mesothelioma data presented. The study authors did aluation was done on the tumor induction through cultured tumors portion			

Study Citation: Duration: Exposure Route, Media, Path:	ration:Overall Duration: > 21 days; Exposure Duration: > 21 daysposure Route,Terrestrial; Air; Inhalationdia, Path:Terrestrial; Air; Inhalation					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Mus musculus</i> ; Strain A male x Strain C female; Juvenile Respiratory asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5) 3617192					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce					
	Metric 1:	Test Substance Identity	Medium	The test substance was not identified by CASRN, but particle size was described in the paper as well as the composition of the asbestos in terms of other chemicals. The asbestos was reported as 7-TF-2 floats.		
	Metric 2:	Test Substance Source	Low	The source of the asbestos was unclear. Study authors reported much of the composition of the asbestos was provided by the manufacturer. It was reported chrysotile was part of the asbestos used, and a chemical analysis of Canadian chrysotile asbestos was provided, but it is unclear if this is the actual source of the asbestos used in the study, or if this is a representative chemical analysis of chrysotile.		
	Metric 3:	Test Substance Purity	Low	The purity was not reported, though a chemical analysis was provided.		
Domain 2: Test Design						
Domain 2: Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control.		
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group can be found in Figures 3 and 5 and in Tables 2 and 4. Study authors reported tumors in control animals, and also reported several deaths to cannibalism and infection.		
	Metric 6:	Randomized Allocation	Low	It was not reported how the mice were allocated into study groups.		
	, . ,.					
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Medium	There were limited details in the preparation of the asbestos concentration. Details on		
	Meure 7.	Preparation	Wedlum	the "dusting" methods were adequate.		
	Metric 8:	Consistency of Exposure Administration	Low	It was reported that a paddle wheel in a metal bin was used to "dust" the entire room of test organisms with asbestos. This was changed partway through the experiment to a trough filled with asbestos behind each row of cages with small rotating metal agitators and air compressors to blow the air toward the cages. This creates inconsistency in the exposure. It was reported that atmospheric concentrations ranged typically between 150,000,000-300,000 particles per square foot throughout the experiment, which also is inconsistent.		
	Metric 9:	Measurement of Test Substance Concentration	Low	It was reported that dust counts were done "on numerous occasions" throughout the study. The frequency of dust counts was not specified, and the methods used to perform the dust counts were described in limited detail.		
	Metric 10:	Exposure Duration and Frequency	Low	This was intended to be a lifetime study of the mice. However, due to cannibalism and infections reported in the control mice, the study was shortened to 19 and 24 months.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure group in this study.		
			Continued on next page			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Mciver, F. A., Cain, , J. R. (1957). Pulmon ation: > 21 days; Exposure Duration: > 21 d Air; Inhalation		sed to asbestos dust. AMA Archives of Industrial Health 15(3):207-214.		
Taxa, Species, Age: Health Outcome:	Vertebrate; Mammalian; <i>Mus musculus</i> ; Strain A male x Strain C female; Juvenile Respiratory					
Chemical: HERO ID:		SRN 1332-21-4)-chrysotile (serpentine) (CA	ASRN 12001-29-5)			
Domain		Metric	Rating	Comments		
	Metric 12:	Testing at or Below Solubility Limit	N/A	This is an asbestos study via inhalation.		
Domain 4: Test Organis	m					
	Metric 13:	Test Organism Characteristics	Low	Study authors reported using an F1 generation of mice that were a cross between Strain A male and Strain C females. It was reported that the Strain A stock was from J. J. Brit- tner of the University of Minnesota. The Strain C stock was from Lloyd W. Law of the National Cancer Institute. Organisms were reported to be two months of age at the start of the study. However, study authors reported that this cross was "probably poorly suited for the purpose." This is due to the formation of asbestos bodies but not pulmonary fibrosis.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported if the mice were acclimated in any way, and the environmental con- ditions were not well described.		
	Metric 15:	Number of Organisms and Replicates per Group	Low	The exact number of mice used for the control and treatments was not reported. Numbers of mice with tumors in both the controls and the exposures were reported in Tables 2-4.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Uninformative	Very little was reported on the environmental conditions of the mice. It was reported that usually 10 or fewer mice were placed in a mesh cage. However, biomass loading was likely too high as authors reported a large amount of cannibalism, infection, and other accidents in control mice. These are overt signs of stress.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology partially addressed or reported the intended outcome–effect on lungs after microscopic examination/assessed for pulmonary tumors.		
	Metric 18:	Consistency of Outcome Assessment	Low	Little details were provided on the execution of the study protocol for outcome assess- ment. The assessment of the lungs was not well described.		
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions or other non-treatment-related factors across study groups.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Study authors described issues with the test organisms not related to the exposure. All animals in the control and exposure were reported to have a large amount of cannibalism and infection, likely due to biomass loading.		
Domain 7: Data Present	tation and Anal	ysis				
	Metric 21: Metric 22:	Statistical Methods Reporting of Data	Low High	Raw data was provided. It may be possible to perform independent statistical analysis. Results for control and exposure animals were reported in Tables 2-4. Figures 3-6 also provide control and exposure group results.		

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		continu	ued from previous	page	
Study Citation: Duration: Exposure Route,	Lynch, K. M., Mciver, F. A., C Overall Duration: > 21 days; I Terrestrial; Air; Inhalation		umors in mice expo	sed to asbestos dust. AMA Archiv	ves of Industrial Health 15(3):207-214.
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Mus re</i> Respiratory asbestos (CASRN 1332-21-4)- 3617192	nusculus; Strain A male x Strain chrysotile (serpentine) (CASRN			
Domain	Metric		Rating		Comments
	Metric 23: Explanation of	Unexpected Outcomes	Low	Variability was not reported.	
Additional Comments:	amount of cannibalism in test r	nice along with infection and ot as unacceptable. The study was	her accidents. This	creates concern regarding biomas	nonths. Study authors reported a large s loading and the health of the animals, ue to the issues above. The respiratory

Uninformative

Study Citation:	Jacobs, R., Humphrys, J., Dodgson, K. S., Richards, R. J. (1978). Light and electron microscope studies of the rat digestive tract following prolonged and short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453. Overall Duration: 4 - 10 days; Exposure Duration: 4 - 10 days						
Duration:							
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:	Terrestriar, I	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; MRC Hooded; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Taxa, Species, Age:	Vertebrate: 1						
Health Outcome:	Dutcome: Gastrointestinal						
Chemical:							
HERO ID:	112						
Domain		Metric	Rating	Comments			
Domain 1: Test Substar	nce						
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	Low	The test substance identity was not analytically verified by the performing laboratory.			
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.			
Domain 2: Test Design							
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure C	haracterization						
Domain 5. Exposure C.	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.			
	Metric 8:	Consistency of Exposure	Medium	Details of exposure administration were not elaborated on.			
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.			
	Metric 10:	Concentration Exposure Duration and Frequency	Low	The duration of exposure was shorter than common dietary rat exposures.			
	Metric 11:	Number of Exposure Groups/	Medium	Only two exposure levels were tested.			
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.			
Domain 4: Test Organi	sm						
Domain 4. 10st Ofgani	Metric 13:	Test Organism Characteristics	Low	Few details were reported, such as initial weight.			
	Metric 13: Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.			
	Metric 15:	Conditions Number of Organisms and	Low	The number of test organisms and/or replicates was not reported.			
		Replicates per Group		•			
Domain 5: Outcome As	ssessment						
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology addressed the intended outcomes of interest, although sample size was not reported.			
		Cont	tinued on nex	ct page			
			D 315				

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continued from previous page							
Study Citation:	Jacobs, R., Humphrys, J., Dodgson, K. S., Richards, R. J. (1978). Light and electron microscope studies of the rat digestive tract following prolonged and short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453.						
Duration:	Overall Duration: 4 - 10 days; Exposure Duration: 4 - 10 days						
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; MRC Hooded; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:	Gastrointestinal						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	112						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome Assessment	Medium	There were minor uncertainties in the outcome assessment study group size.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	N/A	The study focused on pathology findings.			
	Metric 22:	Reporting of Data	Low	Data were only reported for some outcomes.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Quality Determination			Low				

Study Citation: Duration:		E., Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Exposure Route,		Food/Diet; Dietary	iys	
Media, Path:	Terrestriar, I	lood Diet, Dietary		
Taxa, Species, Age:	Vertebrate; I	Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wist	tar: Juvenile	
Health Outcome:	Mortality		,	
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3584909			
Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-
		Preparation	2011	scribe preparation of test substrate/experimental design.
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-
		Administration	-	bestos/margarine. They do not describe details of feeding, such as timing.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
	Mate 10	Spacing of Exposure Levels	NT / A	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organis				
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
		Replicates per Group		
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Low	It was unclear how many rats were killed by subsampling or from being moribund ver- sus allowed to live the remainder of their life span.
		Ca	ntinued on next page	

		c	ontinued from previous p	age	
Study Citation: Duration:		., Davis, G., J.M., Lamb, D. (1982). The paration: > 21 days; Exposure Duration: > 21		ged asbestos ingestion in rats. Environmental Research 29(1):134-150.	
Exposure Route,		Food/Diet: Dietary	aujo		
Media, Path:	, -	· · · · · · · · · · · · · · · · · · ·			
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Rattus norvegicus</i> ; HAN spf W	istar; Juvenile		
Health Outcome:	Mortality		,		
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	3584909				
Domain		Metric	Rating	Comments	
	Metric 18:	Consistency of Outcome	Low	It was not reported when the rats were killed.	
		Assessment			
Domain 6: Confounding	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Present	tation and Anal	vsis			
	Metric 21:	Statistical Methods	Low	Authors state lack of statistical significance in the text of results, but the test was not described.	
	Metric 22:	Reporting of Data	Uninformative	There was mention in the text of no significant difference between treatment and control average survival time, but no numbers were presented/described.	
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.	
Additional Comments:	None				
Overall Quali	ty Deterr	nination	Uninformative		

Duration: (Overall Dura	., Davis, G., J.M., Lamb, D. (1982). The path ation: > 21 days; Exposure Duration: > 21 d Good/Diet; Dietary		nged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Taxa, Species, Age:VHealth Outcome:AChemical:c	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile ADME (biotransformation) chrysotile (serpentine) (CASRN 12001-29-5) 3584909			
Domain		Metric	Rating	Comments
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
N	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
•	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.
Ν	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Chara				
Ν	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.
Ν	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.
Ν	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
Ν	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.
Ν	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
Ν	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Demain 4. Test Orregium				
Domain 4: Test Organism	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 13.	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
-		Replicates per Group		······
Domain 5: Outcome Asses	sment			
Ν	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
Ν	Metric 17:	Outcome Assessment Methodology	Uninformative	Results were reported as fiber type per sample; however it was not stated how much sample was obtained from each rat or whether this was standardized across rats.
N	Metric 18:	Consistency of Outcome Assessment	Medium	Rats were autopsied for fiber analysis after death.
			ontinued on next page .	

Study Citation:	Dolton D E	Davis C. I.M. Lamb D. (1082). The patho?	logical offects of prol	onged asbestos ingestion in rats. Environmental Research 29(1):134-150.	
Duration:		ation: > 21 days; Exposure Duration: > 21 days;		onged asbestos ingestion in fais. Environmental Research 29(1):154-150.	
Exposure Route,		Food/Diet; Dietary	8		
Media, Path:	Terresular, I	ood/Diet, Dietary			
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile				
Health Outcome:	ADME (biotransformation)				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	3584909	spendice) (erister(12001 2) 5)			
Domain		Metric	Rating	Comments	
Domain 6: Confoundin	og / Variable Co	ntrol			
Domain 0. Comountum	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environment	
	Methe 19.	Design and Procedures	LOw	conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Preser	ntation and Anal	vsis			
	Metric 21:	Statistical Methods	N/A	The study focused on presence of fiber type.	
	Metric 22:	Reporting of Data	Low	Results were presented in the table; however, sample size (weight, area) from each ra was not described, nor how many rats were sampled for the fiber analysis.	
	Metric 23:	Explanation of Unexpected Outcomes	Low	It was unclear how much sample was analyzed, therefore one is unable to determine excessive variability was present.	

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	L, Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da Food/Diet; Dietary		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.			
Taxa, Species, Age: Health Outcome: Chemical:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Mortality crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	3584909						
Domain		Metric	Rating	Comments			
Domain 1: Test Substand							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.			
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.			
Domain 2: Test Design							
8	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Demain 2: Emanuel Ch							
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Madia	Low				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.			
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-			
	Methe 0.	Administration	Low	bestos/margarine. They do not describe details of feeding, such as timing.			
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.			
		Concentration					
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, ho			
				many times a day.			
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.			
		Spacing of Exposure Levels					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).			
Domain 4: Test Organisi	n						
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.			
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.			
		Conditions					
	Metric 15:	Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.			
		Replicates per Group					
Domain 5: Outcome Ass	sessment						
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	Low	It is unclear how many rats were killed by subsampling or from being moribund versus allowed to live the remainder of their life span.			
	Metric 18:	Consistency of Outcome Assessment	Low	Data was not reported on when rats were killed.			
		A355851110111					

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		col	ntinued from previous	page			
Study Citation:	Bolton, R. E	., Davis, G., J.M., Lamb, D. (1982). The path	ological effects of prolo	nged asbestos ingestion in rats. Environmental Research 29(1):134-150.			
Duration:	Overall Dura	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile						
Health Outcome:	Mortality	Mortality					
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	3584909						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Con Metric 19:	ntrol Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Low	Authors state lack of statistical significance in text of results, but the test was not de- scribed.			
	Metric 22:	Reporting of Data	Uninformative	There was mention in the text of no significant difference between treatment and contro average survival time, but no numbers were presented/described.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.			
Additional Comments:	None						

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Behavioral amosite (grunerite) (CASRN 12172-73-5) 3584909						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan	ce						
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.			
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.			
Domain 2: Test Design							
U	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
Domain 3: Exposure Ch	aracterization						
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.			
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.			
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.			
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.			
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.			
	M (10	Spacing of Exposure Levels					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).			
Domain 4: Test Organis							
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.			
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.			
	Metric 15:	Number of Organisms and Replicates per Group	Low	The study utilized between 22-24 rats per group without replicates.			
Domain 5: Outcome As	sessment						
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	Low	No details were provided on the food consumption/fecal collection protocol.			
	Metric 18:	Consistency of Outcome Assessment	Low	It was not reported on the timing of the endpoint assessment.			

			1 1 1 66 / 6 1		
Study Citation:				nged asbestos ingestion in rats. Environmental Research 29(1):134-150.	
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ays		
Exposure Route,	Terrestrial; I	Food/Diet; Dietary			
Media, Path:					
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile				
Health Outcome:	Behavioral				
Chemical:	amosite (grunerite) (CASRN 12172-73-5)				
HERO ID:	3584909				
Domain		Metric	Rating	Comments	
Domain 6: Confounding	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental	
		Design and Procedures		conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Present	tation and Anal	lvsis			
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.	
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described the approximate difference	
	Metric 23:	Explanation of Unexpected Outcomes	Low	in food consumption and fecal production between untreated and vehicle-control rats. No measures of variability were reported.	
		Explanation of Chexpected Sutcomes	Low	To moustres of fullability were reported.	
Additional Comments:	None				

Duration: O	verall Dura	., Davis, G., J.M., Lamb, D. (1982). The path tition: > 21 days; Exposure Duration: > 21 d food/Diet; Dietary		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Taxa, Species, Age:VHealth Outcome:MChemical:ar	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Mortality amosite (grunerite) (CASRN 12172-73-5) 3584909			
Domain		Metric	Rating	Comments
Domain 1: Test Substance				
Ν	fetric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	letric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
Ν	Ietric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
e e	fetric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
Μ	letric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.
Ν	letric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 2: Exposure Chara	atorization			
Domain 3: Exposure Charac M	fetric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.
Μ	letric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.
Μ	letric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
Μ	letric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.
Μ	fetric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
Μ	letric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organism				
-	fetric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
Ν	letric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
Μ	letric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
		Replicates per Group		
Domain 5: Outcome Assess	ment			
Μ	letric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
Μ	letric 17:	Outcome Assessment Methodology	Low	It is unclear how many rats were killed by subsampling or from being moribund versus allowed to live the remainder of their life span.
Μ	fetric 18:	Consistency of Outcome Assessment	Low	It was not reported when rats were killed.
		C	ontinued on next page	

Study Citation:	Bolton R F	Davis G IM Lamb D (1982) The path	ological effects of prolo	nged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:		ation: > 21 days; Exposure Duration: > 21 days;				
Exposure Route,		Food/Diet; Dietary				
Media, Path:	, -					
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile					
Health Outcome:	Mortality					
Chemical:	amosite (gru	amosite (grunerite) (CASRN 12172-73-5)				
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confoundir	og / Variable Co	ntrol				
Domain 0. Comoundi	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmenta		
	Mettre 17.	Design and Procedures	Low	conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Preser	ntation and Anal	vsis				
	Metric 21:	Statistical Methods	Low	Authors state lack of statistical significance in text of results, but the test was not de- scribed.		
	Metric 22:	Reporting of Data	Uninformative	There is mention in the text of no significant difference between treatment and contro average survival time, but no numbers were presented/described.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.		
Additional Comments:	None					

Study Citation: Duration: Exposure Route,	Overall Dur	ation: > 21 days; Exposure Duration: > 21	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Media, Path:	ienestria,	i ood Diet, Dietary							
Taxa, Species, Age:	Vertebrate;	Mammalian; <i>Rattus norvegicus</i> ; HAN spf W	/istar; Juvenile						
Health Outcome:		ancer/Carcinogenesis							
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)							
HERO ID:	3584909								
Domain		Metric	Rating	Comments					
Domain 1: Test Substar	ice								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.					
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.					
Domain 2: Test Design									
2 smain 2. Tost Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
D									
Domain 3: Exposure Cl	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-					
	Methe 7.	Preparation	LOW	scribe preparation of test substrate/experimental design.					
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-					
		Administration		bestos/margarine. They do not describe details of feeding, such as timing.					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
		Concentration							
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.					
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.					
	wiente 11.	Spacing of Exposure Levels		There was only one exposure concentration.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).					
Demeir 4. Teet Oreenie									
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.					
	Metric 13:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.					
		Conditions	200	The stady and not report whether test organisms were definituated.					
	Metric 15:	Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.					
	Metric 17:	Outcome Assessment Methodology	Low	Autopsy and histology procedures were not well described. Determination of tumors was not well described.					
	Metric 18:	Consistency of Outcome	Medium	Rats were autopsied after death.					
		Assessment							
		Conti	nued on next pa	ge					

		contin	ued from previo	us page	
Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Cancer/Carcinogenesis crocidolite (riebeckite) (CASRN 12001-28-4) 3584909				
Domain		Metric	Rating	Comments	
Domain 6: Confounding	g / Variable Co Metric 19:	ntrol Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Present		ysis			
	Metric 21:	Statistical Methods	Low	Statistics were performed, but the statistical test was not described.	
	Metric 22: Metric 23:	Reporting of Data Explanation of Unexpected Outcomes	High High	Data was presented in tables and there was some description included in the text. Any unexpected outcomes were satisfactorily explained.	
Additional Comments:	None				
Overall Qualit	ty Deterr	nination	Medium		

Study Citation: Duration: Exposure Route,	Overall Dur	E., Davis, G., J.M., Lamb, D. (1982). The pa ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		s of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.				
Media, Path:	,-							
Taxa, Species, Age:	Vertebrate;	Mammalian; <i>Rattus norvegicus</i> ; HAN spf W	/istar; Juvenile					
Health Outcome:	Cancer/Carc		,					
Chemical:		inerite) (CASRN 12172-73-5)						
HERO ID:	3584909							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar	nce							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.				
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.				
Domain 2: Test Design								
2 sinuin 2. Tost Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure C			т					
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.				
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.				
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.				
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.				
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.				
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).				
	Wieurie 12.	Testing at of Delow Solubility Linit	IVA	Exposure was via diet (marganne).				
Domain 4: Test Organi								
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.				
	Metric 15:	Number of Organisms and Replicates per Group	Low	The study utilized between 22-24 rats per group without replicates.				
Domain 5: Outcome As	ssessment							
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.				
	Metric 17:	Outcome Assessment Methodology	Low	Autopsy and histology procedures were not well described. Determination of tumors was not well described.				
	Metric 18:	Consistency of Outcome Assessment	Medium	Rats were autopsied after death.				
			nued on next pa					

			nucu nom previo			
Study Citation:	Bolton, R. E	., Davis, G., J.M., Lamb, D. (1982). The pa	thological effects	of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; HAN spf W	/istar; Juvenile			
Health Outcome:	Cancer/Carc	inogenesis				
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	v / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	Weute 19.	Design and Procedures	LOW	conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data i resent	Metric 21:	Statistical Methods	Low	Statistics were performed, but the statistical test was not described.		
	Metric 22:	Reporting of Data	High	Data was presented in the tables and some description was included in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Any unexpected outcomes were satisfactorily explained.		
Additional Comments:	None					
Overall Qualit	ty Deterr	nination	Medium			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dur	L, Davis, G., J.M., Lamb, D. (1982). The pa ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		s of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	 Vertebrate; Mammalian; <i>Rattus norvegicus</i>; HAN spf Wistar; Juvenile Mechanistic-Biomarkers (exposure and effect)-Genotox (including DNA repair)-Cancer/Carcinogenesis amosite (grunerite) (CASRN 12172-73-5) 3584909 					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.		
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.		
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.		
Domain 2: Test Design						
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.		
Domain 3: Exposure Ch	aracterization					
2 olinalii of 2.ipoolife ei	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.		
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.		
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.		
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).		
Domain 4: Test Organis	m					
0	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	The study utilized eight and six rats for this analysis from treatment and control, respec- tively.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.		
	Metric 17:	Outcome Assessment Methodology	High	Methodology was well described.		
	Metric 18:	Consistency of Outcome Assessment	High	Rats in this analysis were sampled at 25 months exposure.		

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Study Citation:				of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; HAN spf W	istar; Juvenile			
Health Outcome:	Mechanistic-Biomarkers (exposure and effect)-Genotox (including DNA repair)-Cancer/Carcinogenesis					
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Con	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Presenta	ation and Anal	veis				
Domani 7. Data i resenta	Metric 21:	Statistical Methods	High	Statistics were performed as t-test and significance was stated.		
	Metric 22:	Reporting of Data	High	Data was presented in tables and there was some description included in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Any unexpected outcomes were satisfactorily explained.		
Additional Comments:	This is for th	e amosite treatment only.				
Overall Qualit	ty Detern	nination	Medium			

Duration:	Overall Dura	., Davis, G., J.M., Lamb, D. (1982). The path ation: > 21 days; Exposure Duration: > 21 d Food/Diet; Dietary		nged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Taxa, Species, Age: Health Outcome: Chemical:	ADME (biot	Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wi transformation) nerite) (CASRN 12172-73-5)	star; Juvenile	
Domain		Metric	Rating	Comments
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
-	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Char				
	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-
	Metric 8:	Preparation Consistency of Exposure	Low	scribe preparation of test substrate/experimental design. Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-
	Metric o.	Administration	Low	bestos/margarine. They do not describe details of feeding, such as timing.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
		Concentration		
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, ho many times a day.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
		Spacing of Exposure Levels		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organism				
-	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
		Conditions		
	Metric 15:	Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
		Replicates per Group		
Domain 5: Outcome Asse	ssment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Uninformative	Results were reported as fiber type per sample; however it was not stated how much sample was obtained from each rat or whether this was standardized across rats.
	Metric 18:	Consistency of Outcome Assessment	Medium	Rats were autopsied for fiber analysis after death.
			ontinued on next page .	

			tinued from previou			
Study Citation:				onged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:		ation: > 21 days; Exposure Duration: > 21 day	'S			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; M	Mammalian; Rattus norvegicus; HAN spf Wista	r; Juvenile			
Health Outcome:	ADME (biot	transformation)				
Chemical:	amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confoundin	va / Variabla Ca	ntrol				
Domain 0. Comountum	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environment		
	Meuric 19.	Design and Procedures	LOw	conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Presen		-				
	Metric 21:	Statistical Methods	N/A	The study focused on presence of fiber type.		
	Metric 22:	Reporting of Data	Low	Results were presented in the table; however, sample size (weight, area) from each ra was not described, nor how many rats were sampled for the fiber analysis.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	It was unclear how much sample was analyzed, therefore one is unable to determine excessive variability was present.		

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dur	L, Davis, G., J.M., Lamb, D. (1982). The path ation: > 21 days; Exposure Duration: > 21 d Food/Diet; Dietary		nged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (bio	Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wi transformation) riebeckite) (CASRN 12001-28-4)	star; Juvenile	
Domain		Metric	Rating	Comments
Domain 1: Test Substance	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
2. 1000 Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Cha				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
		Spacing of Exposure Levels		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organisr	n			
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
		Replicates per Group		
Domain 5: Outcome Ass	essment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Uninformative	Results were reported as fiber type per sample; however it was not stated how much sample was obtained from each rat or whether this was standardized across rats.
	Metric 18:	Consistency of Outcome Assessment	Medium	Rats were autopsied for fiber analysis after death.
			ontinued on next page .	

Study Citation:				onged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:		ation: > 21 days; Exposure Duration: > 21 day	/S			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile					
Health Outcome:	ADME (biotransformation)					
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
	Metric 19: Metric 20:	Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	Low Medium	The study did not provide enough information to allow a comparison of environment conditions. There was no information in the study to suggest differences among groups.		
	Mettle 20.	Sucomes emerated to Exposure	Weddulli	There was no mormation in the study to suggest differences among groups.		
Domain 7: Data Presen	tation and Anal	ysis				
	Metric 21:	Statistical Methods	N/A	The study focused on presence of fiber type.		
	Metric 22:	Reporting of Data	Low	Results were presented in the table; however, sample size (weight, area) from each ra was not described, nor how many rats were sampled for the fiber analysis.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	It was unclear how much sample was analyzed, therefore one is unable to determine excessive variability was present.		

Study Citation: Duration:		E., Davis, G., J.M., Lamb, D. (1982). The pa ation: > 21 days; Exposure Duration: > 21	-	s of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150
Exposure Route,		Food/Diet; Dietary	-	
Media, Path:				
Taxa, Species, Age:		Mammalian; Rattus norvegicus; HAN spf W	istar; Juvenile	
Health Outcome:	Cancer/Carc			
Chemical: HERO ID:	3584909	serpentine) (CASRN 12001-29-5)		
Domain	5561767	Metric	Rating	Comments
Domain 1: Test Substar	nce	Wiettle	Rating	Comments
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
2 chian 2. Tost Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure C	haracterization			
Domain 5. Exposure C	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-
		Preparation		scribe preparation of test substrate/experimental design.
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, ho
				many times a day.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
	M . · 10	Spacing of Exposure Levels	NT/A	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organis				
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	The study utilized between 22-24 rats per group without replicates.
Domain 5: Outcome As	ssessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Low	Autopsy and histology procedures were not well described. Determination of tumors was not well described.
	Metric 18:	Consistency of Outcome Assessment	Medium	Rats were autopsied after death.
			nued on next pa	

		contin	ued from previo	us page	
Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, G., J.M., Lamb, D. (1982). The patation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary	-	of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.	
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Cancer/Carcinogenesis chrysotile (serpentine) (CASRN 12001-29-5) 3584909				
Domain		Metric	Rating	Comments	
Domain 6: Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Present	ation and Anal	vsis			
	Metric 21:	Statistical Methods	Low	Statistics were performed but the statistical test was not described.	
	Metric 22:	Reporting of Data	High	Data was presented in tables and some description was included in the text.	
	Metric 23:	Explanation of Unexpected Outcomes	High	Any unexpected outcomes were satisfactorily explained.	
Additional Comments:	None				
Overall Qualit	ty Detern	nination	Medium		

Study Citation: Duration: Exposure Route,	Overall Dura	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Media, Path:	10110501101,1							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; HAN spf Wist	ar; Juvenile					
Health Outcome:	Developmen	nt/Growth						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)						
HERO ID:	3584909							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.				
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.				
Domain 2: Test Design								
2 omain 2. Toot Doorgh	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch	aracterization							
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-				
	Wetter /.	Preparation	Low	scribe preparation of test substrate/experimental design.				
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-				
		Administration		bestos/margarine. They do not describe details of feeding, such as timing.				
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.				
	M (10	Concentration						
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.				
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.				
		Spacing of Exposure Levels		· · · · · · · · · · · · · · · · · · ·				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).				
Domain 4: Test Organis	m							
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.				
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.				
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.				
		Replicates per Group						
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.				
	Metric 17:	Outcome Assessment Methodology	Low	No details were provided of weighing regime.				
	Metric 18:	Consistency of Outcome	Low	It was not reported on when the rats were weighed.				
		Assessment	20	r-r-r-				

		CO	ntinued from previous	page		
Study Citation:				nged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 da	ays			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile					
Health Outcome:	Development/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Matria 20.	Design and Procedures	Medium			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present		ysis				
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.		
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described the approximate difference in weight between untreated and vehicle-control rats.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.		
Additional Comments:	None					

Study Citation: Duration:		E., Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.				
Exposure Route,	Terrestrial; I	Food/Diet; Dietary						
Media, Path:								
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; HAN spf Wist	ar; Juvenile					
Health Outcome:	Behavioral							
Chemical:	•	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3584909							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.				
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.				
Domain 2: Test Design								
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch	aracterization							
	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-				
		Preparation		scribe preparation of test substrate/experimental design.				
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-				
		Administration		bestos/margarine. They do not describe details of feeding, such as timing.				
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how				
	Metric 11:	Number of Exposure Groups/	N/A	many times a day. There was only one exposure concentration.				
	metric 11.	Spacing of Exposure Levels	11/17	There was only one exposure concentration.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).				
Domoin 4. Toot Orregia								
Domain 4: Test Organis	m Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.				
	Metric 13:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.				
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.				
		Replicates per Group	20					
Domain 5: Outcome As	sessment							
Domain J. Outcome As	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.				
	Metric 10.	Outcome Assessment Methodology	Low	No details were provided on the food consumption/fecal collection protocol.				
	Metric 17.	Consistency of Outcome	Low	It was not reported on the timing of the endpoint assessment.				
	mente 10.	Assessment	LUW	it was not reported on the timing of the enupoint assessment.				

		c	ontinued from previous pa	ige			
Study Citation:	Bolton, R. E	Bolton, R. E., Davis, G., J.M., Lamb, D. (1982). The pathological effects of prolonged asbestos ingestion in rats. Environmental Research 29(1):134-150.					
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 d	days	-			
Exposure Route,	Terrestrial; H	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile						
Health Outcome:	Behavioral						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	3584909						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
Domain 7. Dua Present	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.			
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described the approximate difference in food consumption and fecal production between untreated and vehicle-control rats.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.			
Additional Comments:	None						
Overall Qualit	ty Deterr	nination	Uninformative				

Study Citation: Duration: Exposure Route, Madia Batha	Overall Dura	L, Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da Food/Diet; Dietary		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.					
Media, Path: Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; HAN spf Wist	ar; Juvenile						
Health Outcome:		Development/Growth amosite (grunerite) (CASRN 12172-73-5)							
Chemical:	amosite (gru								
HERO ID:	3584909								
Domain		Metric	Rating	Comments					
Domain 1: Test Substand	ce								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.					
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	aracterization								
- · · · · · · · · · · · · · · · · · · ·	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-					
		Preparation		scribe preparation of test substrate/experimental design.					
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-					
	Matria 0.	Administration Measurement of Test Substance	Low	bestos/margarine. They do not describe details of feeding, such as timing.					
	Metric 9:	Concentration	Low	Exposure concentrations were not measured.					
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.					
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.					
		Spacing of Exposure Levels							
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).					
Domain 4: Test Organisi	n								
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.					
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.					
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.					
		Replicates per Group							
Domain 5: Outcome Ass	sessment								
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.					
	Metric 17:	Outcome Assessment Methodology	Low	No details were provided of weighing regime.					
	Metric 18:	Consistency of Outcome Assessment	Low	It was not reported when the rats were weighed.					

			ntinued from previous	page			
Study Citation:	Bolton, R. E	., Davis, G., J.M., Lamb, D. (1982). The path	ological effects of prolo	nged asbestos ingestion in rats. Environmental Research 29(1):134-150.			
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 da	ays				
Exposure Route,	Terrestrial; F	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile						
Health Outcome:	Development/Growth						
Chemical:	amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	3584909						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmenta			
		Design and Procedures		conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	lysis					
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.			
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described the approximate difference in weight between untreated and vehicle-control rats.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.			
Additional Comments:	None						

Study Citation: Duration:		L, Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.
Exposure Route,		Food/Diet; Dietary	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Media, Path:	, -			
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wist	ar: Juvenile	
Health Outcome:	Behavioral		,	
Chemical:		riebeckite) (CASRN 12001-28-4)		
HERO ID:	3584909			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.
Domain 2: Test Design				
in the second se	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Bomain 5. Exposure en	Metric 7:	Experimental System/Test Media	Low	Authors cited methodology; however the cited methodology does not adequately de-
	Wether /	Preparation	2011	scribe preparation of test substrate/experimental design.
	Metric 8:	Consistency of Exposure	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as-
		Administration		bestos/margarine. They do not describe details of feeding, such as timing.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.
	Metho II.	Spacing of Exposure Levels	1.071	There was only one exposure concentration.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	The study utilized between 22-24 rats per group without replicates.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Low	No details were provided on the food consumption/fecal collection protocol.
	Metric 18:	Consistency of Outcome Assessment	Low	It was not reported on the timing of the endpoint assessment.

		co l	ntinued from previous	page			
Study Citation:	Bolton, R. E	., Davis, G., J.M., Lamb, D. (1982). The path	ological effects of prolo	nged asbestos ingestion in rats. Environmental Research 29(1):134-150.			
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 da	ays				
Exposure Route,	Terrestrial; H	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile					
Health Outcome:	Behavioral						
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	3584909						
Domain		Metric	Rating	Comments			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmenta conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.			
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described an approximate difference in food consumption and fecal production between untreated and vehicle-control rats.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.			
Additional Comments:	None						

Study Citation: Duration: Exposure Route,	Overall Dura	L, Davis, G., J.M., Lamb, D. (1982). The patho ation: > 21 days; Exposure Duration: > 21 da Food/Diet; Dietary		onged asbestos ingestion in rats. Environmental Research 29(1):134-150.				
Media, Path: Taxa, Species, Age: Health Outcome:		Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; HAN spf Wistar; Juvenile Development/Growth crocidolite (riebeckite) (CASRN 12001-28-4) 3584909						
Chemical: HERO ID:	crocidolite (
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce							
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	Samples were UICC reference samples, referenced to Rendall 1980.				
	Metric 3:	Test Substance Purity	High	Characterization of UICC reference samples was described in Rendall 1980.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	Low	The biological response of the negative control group was not reported.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch	aracterization							
Ĩ	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately de- scribe preparation of test substrate/experimental design.				
	Metric 8:	Consistency of Exposure Administration	Low	Authors report approximate loading of 250 mg asbestos per week per rat and 5 mg as- bestos/margarine. They do not describe details of feeding, such as timing.				
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.				
	Metric 10:	Exposure Duration and Frequency	Medium	The duration of exposure was reported as 25 months and suitable for the study type. It was not explicitly stated if feeding of treatment with margarine was daily and, if so, how many times a day.				
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration.				
	M (10	Spacing of Exposure Levels	NT/A					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet (margarine).				
Domain 4: Test Organis								
	Metric 13:	Test Organism Characteristics	High	Strain, age, and sex of rats were reported.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.				
	Metric 15:	Number of Organisms and Replicates per Group	Low	The study utilized between 22-24 rats per group without replicates.				
Domain 5: Outcome As	aaamant							
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to avaluate if adapted				
	Metric 16: Metric 17:	Outcome Assessment Methodology	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.				
		Consistency of Outcome	Low	No details were provided of weighing regime.				
	Metric 18:	Assessment	LOW	It was not reported on when the rats were weighed.				

			ntinued from previous			
Study Citation:				nged asbestos ingestion in rats. Environmental Research 29(1):134-150.		
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ays			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; HAN spf Wistar; Juvenile					
Health Outcome:	Development/Growth					
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)					
HERO ID:	3584909					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmenta		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	tation and Anal	vsis				
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.		
	Metric 22:	Reporting of Data	Uninformative	Chemical-specific data was not reported. Authors described the approximate difference in weight between untreated and vehicle-control rats.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	No measures of variability were reported.		
Additional Comments:	None					

Study Citation:				estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.		
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:		Mammalian; <i>Rattus norvegicus</i> ; SPF Han; N	ot Applicable (e	.g., fungi or algae studies) or Not Reported		
Health Outcome: Chemical:		e specify below) (Bioaccumulation)	74 SDN 12001 2	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN		
Cilemicai:	12172-73-5)	• • • • •	ASKIN 12001-2	(CASKN 12001-28-4)-amosne (grunefile) (CASKN 12001-28-4)-amosne (grunefile) (CASKN		
HERO ID:	3615355					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand						
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.		
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.		
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.		
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.		
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.		
Domain 3: Exposure Cha	aracterization					
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described		
		Preparation	-	in adequate detail-the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.		
	Metric 8:	Consistency of Exposure	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi-		
		Administration		mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.		
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.		
Domain 4: Test Organisi	n					
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.		
			nued on next pa	100		

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Study Citation:	Bolton, R. E	., Davis, J. M. (1976). The short-term effects	s of chronic asb	estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.			
Duration:	Overall Dura	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:		Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported Other (please specify below) (Bioaccumulation)					
Health Outcome:	Other (please specify below) (Bioaccumulation)						
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASR						
HERO ID:	12172-73-5) 3615355						
Domain		Metric	Rating	Comments			
	Metric 15:	Number of Organisms and	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls			
		Replicates per Group		In the second experiment there were 2 rats per fiber type and a control.			
Domain 5: Outcome As	ssessment						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.			
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash ing analysis. This was due to acid susceptibility of chrysotile.			
Demein (+ Cenferradia	- / Veriable Ca						
Domain 6: Confoundin	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
	Wieute 19.	Design and Procedures	Low	conditions-the study did not report if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Presen	tation and Anal	veic					
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.			
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.			

Medium

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effec ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Gastrointest	ASRN 1332-21-4)-chrysotile (serpentine) (g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substar	ice			
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
-	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Cl	aractorization			
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis	sm			
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page			
Study Citation:				estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial: Food/Diat: Diatary						
Exposure Route,	Terrestrial; F	Terrestrial; Food/Diet; Dietary					
Media, Path:							
Гаха, Species, Age:	,	Mammalian; Rattus norvegicus; SPF Han; N	ot Applicable (e	.g., fungi or algae studies) or Not Reported			
Health Outcome:		Gastrointestinal asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (gruperite) (CASRN					
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-72-7)						
UEDO ID.	12172-73-5) 3615355	12172-73-5)					
HERO ID:	3615355						
Domain		Metric	Rating	Comments			
Domain 5: Outcome Ass							
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.			
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.			
Domain 6: Confounding	/ Variable Co	ntrol					
-	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditionsthe study did not report if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.			
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.			
Additional Comments:	This form is for Amosite; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Cellular (Histology-Histological changes, general, Response Site Gastrointestinal tract).						

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Overall Dura Terrestrial; H Vertebrate; M Development asbestos (CA 12172-73-5)	ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary Mammalian; <i>Rattus norvegicus</i> ; SPF Han; N ht/Growth ASRN 1332-21-4)-chrysotile (serpentine) ((days Not Applicable (e	estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. .g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substar				
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
D	· · · · · · · · · · · · · · · · · · ·			
Domain 3: Exposure Cl	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail-the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis	sm			
C C	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page			
Study Citation: Duration: Exposure Route,	Overall Dura	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Media, Path:	10110301101,1						
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Rattus norvegicus</i> ; SPF Han; N	ot Applicable (e	.g., fungi or algae studies) or Not Reported			
Health Outcome:	Developmen		II				
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	3615355						
Domain	Metric Rating Comments						
Domain 5: Outcome Ass							
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest–changes in the gastrointestinal tract due to asbestos fibers.			
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.			
Domain 6: Confounding	/ Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Presenta	ation and Anal	vsis					
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.			
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.			
Additional Comments:	This form is reported).	for Amosite; Exposure duration 2-52 Week	(s); Study Durati	ion 1 Year(s); Growth (Development-Abnormal, Deformation, Response Site: No			
Overall Qualit	y Detern	nination	Medium				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Gastrointest	ASRN 1332-21-4)-chrysotile (serpentine) (g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN				
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar	ice							
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.				
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.				
Domain 2: Test Design								
-	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.				
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.				
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.				
Domain 3: Exposure Cl	aractorization							
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.				
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.				
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.				
Domain 4: Test Organis	sm							
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.				
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls In the second experiment there were 2 rats per fiber type and a control.				

		contin	ued from previ	ous page		
Study Citation: Duration: Exposure Route, Madia Bath:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Media, Path: Taxa, Species, Age:						
Health Outcome:	Gastrointestinal					
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN					
HERO ID:	12172-73-5) 3615355					
Domain	Metric Rating Comments					
Domain 5: Outcome Ass						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ashing analysis. This was due to acid susceptibility of chrysotile.		
Domain 6: Confounding	/ Variable Co	ntrol				
e	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Presenta	ation and Anal	veis				
Domain 7. Data Present	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	Response Sit tract). This s	te: Gastrointestinal tract); Exposure duration	n 2-52 weeks; C estos fibers, chry	2 weeks; study duration 1 yearCellular (Histology-Histological changes, general, cellular (Histology-Histological changes, general, Response Site: Gastrointestinal votile, crocidolite, and amosite, on the gastrointestinal tract of male SPF Han rats. estinal tract.		

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effect ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Other (pleas asbestos (CA 12172-73-5)			.g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substan		— • • • •		
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page		
Study Citation:	Bolton, R. E	., Davis, J. M. (1976). The short-term effect	s of chronic asb	estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.		
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:		Mammalian; Rattus norvegicus; SPF Han; N	ot Applicable (e	.g., fungi or algae studies) or Not Reported		
Health Outcome:	Other (please specify below) (Bioaccumulation) asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-72-5)					
Chemical:						
HERO ID:	12172-73-5) 3615355					
Domain	Metric Rating Comments					
Domain 5: Outcome Ass	sessment					
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest–changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ashing analysis. This was due to acid susceptibility of chrysotile.		
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	This form w Feces, Gut).	vas for Crocidolite; Exposure duration ~1	~8 Week(s); Stu	dy Duration ~2 Month(s)Accumulation (Accumulation-Residue, Response Site:		
Overall Qualit	ty Detern	nination	Medium			

... continued from previous page

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effect ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Other (pleas asbestos (CA 12172-73-5)			.g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substan		— • • • •		
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page		
tudy Citation:	Bolton, R. E	., Davis, J. M. (1976). The short-term effects	s of chronic asb	estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.		
ouration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
xposure Route,	Terrestrial; Food/Diet; Dietary					
Iedia, Path:						
axa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; SPF Han; No	ot Applicable (e	.g., fungi or algae studies) or Not Reported		
lealth Outcome:	Other (please specify below) (Bioaccumulation)					
Chemical:			CASRN 12001-2	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN		
	12172-73-5) 2615355					
IERO ID:	3615355					
Domain		Metric	Rating	Comments		
Oomain 5: Outcome As						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.		
Oomain 6: Confounding			-			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Oomain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effect ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Other (pleas asbestos (CA 12172-73-5)			.g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substan		— • • • •		
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page		
Study Citation:				estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.		
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial: Food/Diet: Dietary					
Exposure Route,	Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Media, Path:						
Taxa, Species, Age:			ot Applicable (e	.g., fungi or algae studies) or Not Reported		
Health Outcome:	Other (please specify below) (Bioaccumulation) scheetes (CASPN 1332 21 4) chrystile (sementine) (CASPN 12001 29 5) crocidelite (riebeckite) (CASPN 12001 28 4) amocite (gruperite) (CASPN					
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	12172-73-5) 3615355					
Domain		Metric	Comments			
Domain 5: Outcome Ass						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.		
Domain 6: Confounding	y / Variable Cor	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	This form is Gut).	for Amosite; Exposure duration ~1-~8 Wee	ek(s); Study Dur	ation ~2 Month(s); Accumulation (Accumulation-Residue, Response Site: Feces		
Overall Qualit		nination	Medium			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Gastrointest	ASRN 1332-21-4)-chrysotile (serpentine) (g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN				
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar	ice							
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.				
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.				
Domain 2: Test Design								
-	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.				
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.				
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.				
Domain 3: Exposure Cl	aractorization							
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.				
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.				
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.				
Domain 4: Test Organis	sm							
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.				
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls In the second experiment there were 2 rats per fiber type and a control.				

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Study Citation:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days: Exposure Duration: > 21 days.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported Gastrointestinal					
Taxa, Species, Age:						
Health Outcome:						
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)					
HERO ID:	3615355	3615355				
Domain		Metric	Rating	Comments		
Domain 5: Outcome As						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash ing analysis. This was due to acid susceptibility of chrysotile.		
		. 1				
Domain 6: Confounding	Metric 19:		Law			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Present	ation and Anal	veje				
Domain 7. Data Present	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re-		
	Wette 23.	Explanation of Onexpected Outcomes	Weddulli	ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	This form is for Crocidolite; growth/development; exposure duration 2-52 weeks; study duration 1 yearCellular (Cell(s)-Cell changes, Organelle changes, Response Site: Gastrointestinal tract, Lymph node, Small intestine). Exposure duration 2-52 weeks; Cellular (Histology-Histological changes, general, Response Site: Gastrointestinal tract); This study observed the long term effects of 3 asbestos fibers, chrysotile, crocidolite, and amosite, on the gastrointestinal tract of male SPF Han rats. Three experiments were performed and all were to observe the gastrointestinal tract.					

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dur	2., Davis, J. M. (1976). The short-term effec ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Other (pleas asbestos (CA 12172-73-5)			.g., fungi or algae studies) or Not Reported 9-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substan			_	
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
-	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	naracterization			
2 onium 01 2.iposine er	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.
	Metric 8:	Consistency of Exposure Administration	High	Ats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organis				
	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

ll Durat strial; Fo orate; M (please	 tion: > 21 days; Exposure Duration: > 21 o ood/Diet; Dietary Iammalian; <i>Rattus norvegicus</i>; SPF Han; Notes specify below) (Bioaccumulation) 	days ot Applicable (e	estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. .g., fungi or algae studies) or Not Reported 29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed
strial; Fo prate; M (please tos (CA 2-73-5) 555 tt c 16:	ood/Diet; Dietary Iammalian; <i>Rattus norvegicus</i> ; SPF Han; Ne specify below) (Bioaccumulation) SRN 1332-21-4)-chrysotile (serpentine) (C Metric	ot Applicable (e CASRN 12001-2 Rating	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
orate; M (please tos (CA 2-73-5) 555 tt c 16:	Iammalian; <i>Rattus norvegicus</i> ; SPF Han; Ne specify below) (Bioaccumulation) SRN 1332-21-4)-chrysotile (serpentine) (C Metric	CASRN 12001-2 Rating	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
(please tos (CA 2-73-5) 555 tt c 16:	specify below) (Bioaccumulation) SRN 1332-21-4)-chrysotile (serpentine) (C Metric	CASRN 12001-2 Rating	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
(please tos (CA 2-73-5) 555 tt c 16:	specify below) (Bioaccumulation) SRN 1332-21-4)-chrysotile (serpentine) (C Metric	CASRN 12001-2 Rating	29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
tos (CA 2-73-5) 355 .t c 16:	SRN 1332-21-4)-chrysotile (serpentine) (C	Rating	Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
2-73-5) 355 it c 16:	Metric	Rating	Comments Organism housing, environmental conditions, food, water, and nutrients were conducive
855 it c 16:			Organism housing, environmental conditions, food, water, and nutrients were conducive
c 16:			Organism housing, environmental conditions, food, water, and nutrients were conducive
c 16:	Adequacy of Test Conditions	High	
	Adequacy of Test Conditions	High	
. 17.			with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.
C 17.	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest–changes in the gastrointestinal tract due to asbestos fibers.
c 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.
ble Con	trol		
c 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.
c 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.
d Analy	vsis		
c 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.
c 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.
c 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.
orm is f	for Chrysotile; Exposure duration ~1-~8 We	eek(s); Study Du	ration ~2 Month(s); Accumulation (Accumulation-Residue, Response Site: Feces
	ble Con 2 19: 2 20: d Analy 2 21: 2 22: 2 23: borm is f	Assessment Assessment Del Control 2 19: Confounding Variables in Test Design and Procedures 2 20: Outcomes Unrelated to Exposure d Analysis 2 21: Statistical Methods 2 22: Reporting of Data 2 23: Explanation of Unexpected Outcomes	Assessment

Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Vertebrate; N					
HERO ID:	Other (please					
Domain		Metric	Rating	Comments		
Domain 1: Test Substance	e		8			
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.		
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.		
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.		
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.		
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.		
Domain 3: Exposure Cha	racterization Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail-the three different asbestos fibers were mixed in margarine at 5mg		
	Metric 8:	Consistency of Exposure Administration	High	asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.Rats were fed margarine dosed with a particular asbestos fiber at a dose of approximately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along		
			_	with a pelleted diet. Exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.		
Domain 4: Test Organism						
Bomani 4. Test Organishi	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.		

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Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age:	Vertebrate: N	Jammalian: Rattus norvegicus: SPE Han: N	ot Applicable (e	a fungi or algae studies) or Not Reported		
Health Outcome:	Other (please specify below) (Bioaccumulation) asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)					
Chemical:						
HERO ID:	3615355					
Domain		Metric	Rating	Comments		
Domain 5: Outcome Ass						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.		
Domain 6: Confounding	r / Variable Cou	ntrol				
Pointain 0. Controllading	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Presenta	ation and Anal	veis				
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability reported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	This form is Gut).	for Chrysotile; Exposure duration 13 Mont	h(s); Study Dura	ation 13 Month(s). Accumulation (Accumulation-Residue, Response Site: Feces		
Overall Qualit	ty Determ	nination	Medium			

... continued from previous page

Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age: Health Outcome: Chemical:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported Other (please specify below) (Bioaccumulation) asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CAS 12172-73-5)					
HERO ID:	3615355					
Domain Domain 1: Test Substand	<u>```</u>	Metric	Rating	Comments		
Domain 1. Test Substand	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.		
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.		
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.		
Domain 2: Test Design						
-	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.		
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.		
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.		
Domain 3: Exposure Cha	practerization					
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.		
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.		
Domain 4. Toot Orres						
Domain 4: Test Organisi	n Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls In the second experiment there were 2 rats per fiber type and a control.		

		contin	ued from previ	ous page		
Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; SPF Han; N	ot Applicable (e	.g., fungi or algae studies) or Not Reported		
Health Outcome:	Other (please specify below) (Bioaccumulation) asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5) 3615355					
Chemical:						
HERO ID:						
	3013333					
Domain		Metric	Rating	Comments		
Domain 5: Outcome Ass			*** 1			
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest–changes in the gastrointestinal tract due to asbestos fibers.		
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.		
Domain 6: Confounding	/ Variable Co	ntrol				
Pointain 0. Controllanding	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.		
Domain 7: Data Presenta	ation and Anal	vsis				
, • <i>D</i> and • 1050114	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.		
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.		
Additional Comments:	This form is Gut).	for Chrysotile; Exposure duration 2-52 We	eek(s); Study D	uration 1 Year(s); Accumulation (Accumulation-Residue, Response Site: Feces		
Overall Qualit	y Detern	nination	Medium			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effec ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Gastrointesti	ASRN 1332-21-4)-chrysotile (serpentine) (.g., fungi or algae studies) or Not Reported 19-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The cost substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	aracterization			
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organisi	m			
Somen i. Tost organis	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

overall Dura errestrial; F Vertebrate; N	, Davis, J. M. (1976). The short-term effect tion: > 21 days; Exposure Duration: > 21 ood/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.				
	ge: Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported						
	, Species, Age: Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported th Outcome: Gastrointestinal						
asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (GRN 12001-28-4)-amosite (grunerite) (grune							
12172-73-5)							
615355							
	Metric	Rating	Comments				
sment							
fetric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.				
letric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.				
letric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.				
Inriable Cor	atral						
fetric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.				
fetric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
n and Analy	vsis						
fetric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.				
fetric 22:		Low	Data for exposure related findings was described in the text.				
fetric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.				
		ek(s); Study Dur	ation 1 Year(s); Cellular (Cell(s)-Cell changes, Organelle changes, Response Site				
	ment etric 16: etric 17: etric 18: ariable Cor etric 19: etric 20: n and Analy etric 21: etric 22: etric 23: nis form is astrointesti	Metric ment ietric 16: Adequacy of Test Conditions ietric 17: Outcome Assessment Methodology ietric 18: Consistency of Outcome Assessment ariable Control Erric 19: ietric 20: Outcomes Unrelated to Exposure n and Analysis Erric 21: statistical Methods Erric 22: retric 23: Explanation of Unexpected Outcomes	Metric Rating ment				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effec ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Gastrointesti	ASRN 1332-21-4)-chrysotile (serpentine) (.g., fungi or algae studies) or Not Reported 19-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The cost substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Ch	aracterization			
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organisi	m			
Somen i. Tost organis	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page			
Study Citation: Duration: Exposure Route,	Overall Dura	., Davis, J. M. (1976). The short-term effect: ation: > 21 days; Exposure Duration: > 21 of Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.			
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:							
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite)						
HERO ID:	12172-73-5) 3615355						
Domain		Metric	Rating	Comments			
Domain 5: Outcome Ass	sessment						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.			
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.			
Domain 6: Confounding	r / Variable Co	ntrol					
Domain 0. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures		conditions-the study did not report if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Presenta	ation and Anal	vsis					
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.			
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.			
Additional Comments:	This form is Gastrointest	•	ek(s); Study Dur	ation 1 Year(s); Cellular (Histology-Histological changes, general, Response Site			
Overall Qualit	ty Deterr	nination	Medium				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	., Davis, J. M. (1976). The short-term effect ation: > 21 days; Exposure Duration: > 21 Good/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.
Taxa, Species, Age: Health Outcome: Chemical:	Developmen	ASRN 1332-21-4)-chrysotile (serpentine) (.g., fungi or algae studies) or Not Reported 19-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN
HERO ID:	3615355			
Domain		Metric	Rating	Comments
Domain 1: Test Substand	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Domain 2: Test Design				
B.	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Cha	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.
	Metric 8:	Consistency of Exposure Administration	High	Ats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Domain 4: Test Organisr	n			
Comun 1. 10st Organisi	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.
	Metric 15:	Conditions Number of Organisms and	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.

		contin	ued from previ	ous page			
Study Citation: Duration: Exposure Route,	Overall Dura	., Davis, J. M. (1976). The short-term effect ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary		estos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.			
Media, Path:	Vertebrate; Mammalian; Rattus norvegicus; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Taxa, Species, Age: Health Outcome:		, , , , , , , , , , , , , , , , , , ,	ot Applicable (e	g., tungi or algae studies) or Not Reported			
Chemical:	Development/Growth asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) 12172-73-5) 3615355						
Chemical:							
HERO ID:							
Domain		Metric	Rating	Comments			
Domain 5: Outcome Ass	sessment						
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.			
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.			
Domain 6: Confounding	/ Variable Co	ntrol					
Domain of Confounding	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Presenta	ation and Anal	veie					
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.			
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.			
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were not measures of variability reported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.			
Additional Comments:	This form is Not reported		eek(s); Study Du	ration 1 Year(s); Growth (Development-Abnormal, Deformation, Response Site			
Overall Qualit	v Detern	nination	Medium				

Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary							
Taxa, Species, Age: Health Outcome: Chemical:	Other (pleas asbestos (CA 12172-73-5)	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported Other (please specify below) (Bioaccumulation) asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 1: Test Substand	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.				
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.				
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.				
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.				
Domain 3: Exposure Cha	aracterization							
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail-the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.				
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.				
Domain 4: Test Organisr	n							
Jomani 4. 16st Orgallisi	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.				
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.				
	Metric 15:	Conditions Number of Organisms and	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls.				

Study Citation:	Bolton R E	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.						
Duration:		ation: > 21 days; Exposure Duration: > 21 d						
Exposure Route,		Food/Diet; Dietary	iays					
Media, Path:	Terrestriar, 1	ood Diet, Dietary						
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; SPF Han; No	ot Applicable (e	g fungi or algae studies) or Not Reported				
Health Outcome:		e specify below) (Bioaccumulation)	or Applicable (e	g., rungi of argue studies) of Not Reported				
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRI							
Chemicai.	12172-73-5)							
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 5: Outcome A	ssessment		0					
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.				
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ashing analysis. This was due to acid susceptibility of chrysotile.				
Domain 6: Confoundin	g / Variable Co	ntrol						
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Presen	tation and Anal	ysis						
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.				
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Taxa, Species, Age: Health Outcome: Chemical:	Developmen	ASRN 1332-21-4)-chrysotile (serpentine) (.g., fungi or algae studies) or Not Reported 19-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN					
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 1: Test Substand	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.				
	Metric 2:	Test Substance Source	Low	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.				
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.				
Domain 2: Test Design								
B.	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.				
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.				
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.				
Domain 3: Exposure Cha	aracterization							
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbestos per rat.				
	Metric 8:	Consistency of Exposure Administration	High	Ats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.				
Domain 4: Test Organisr	n							
Comun 1. 10st Organisi	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.				
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.				
	Metric 15:	Conditions Number of Organisms and	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.				

Steeder Citedians	Daltan D.E	Denie I.M. (1076) The short terms offer the	f - h i h					
Study Citation: Duration:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Terrestrial; Food/Diet; Dietary							
Media, Path:								
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; SPF Han; No	ot Applicable (e	g fungi or algae studies) or Not Reported				
Health Outcome:	Developmen		or ripplicable (e	g., rungi of ulgue studies) of rot reported				
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (GRN 12001-28-4)-amosite (grunerite)							
	12172-73-5)							
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.				
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash ing analysis. This was due to acid susceptibility of chrysotile.				
		<i>.</i> .						
Domain 6: Confounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
	Metho 19.	Design and Procedures	Low	conditions-the study did not report if the rats were acclimated to test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Present	ation and Anal	veis						
Bonnann 7. Data i resent	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.				
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.				
Additional Comments:	reported). E intestine). T	gastrointestinal tract. This form is for Crocidolite; exposure duration 2-52 weeks; study duration 1 year; Growth (Development-Abnormal, Deformation, Response Site: Not reported). Exposure duration 2-52 weeks; Cellular (Cell(s)-Cell changes, Organelle changes, Response Site: Gastrointestinal tract, Lymph node ,Small intestine). This study observed the long term effects of 3 asbestos fibers, chrysotile, crocidolite, and amosite, on the gastrointestinal tract of male SPF Han rats. Three experiments were performed and all were to observe the gastrointestinal tract.						

Mammalian; <i>Rattus norvegicus</i> ; SPF Han; N se specify below) (Bioaccumulation) ASRN 1332-21-4)-chrysotile (serpentine) () <u>Metric</u> Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Controls Negative Control Response	CASRN 12001-2 Rating Low Low Medium	.g., fungi or algae studies) or Not Reported 29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN Comments The test substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified. The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.
Test Substance Identity Test Substance Source Test Substance Purity Negative Controls	Low Low Medium	The test substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified. The chrysotile, crocidolite, and amosite were all reported as UICC standard references,
Test Substance Identity Test Substance Source Test Substance Purity Negative Controls	Low Low Medium	The test substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified. The chrysotile, crocidolite, and amosite were all reported as UICC standard references,
Test Substance Source Test Substance Purity Negative Controls	Low Medium	The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified. The chrysotile, crocidolite, and amosite were all reported as UICC standard references,
Test Substance Purity Negative Controls	Medium	analytically verified. The chrysotile, crocidolite, and amosite were all reported as UICC standard references,
Negative Controls		•
e		
e		
Negative Control Response	High	Negative controls were reported to be used in each portion of the study.
	High	The response of the negative controls was reported in the text under the "results" sec- tion.
Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail-the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.
Consistency of Exposure Administration	High	Ats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.
Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.
Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.
Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.
Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.
Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.
Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.
Number of Organisms and	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.
	Testing at or Below Solubility Limit Test Organism Characteristics Acclimatization and Pretreatment Conditions	Testing at or Below Solubility LimitN/ATest Organism CharacteristicsMediumAcclimatization and PretreatmentLowConditionsMedium

Study Citation:	Bolton R E	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128.						
Duration:		ation: > 21 days; Exposure Duration: > 21 d						
Exposure Route,	Terrestrial; Food/Diet; Dietary							
Media, Path:	Terrestriar, 1	ood Diet, Dietary						
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; SPF Han; No	ot Applicable (e	g fungi or algae studies) or Not Reported				
Health Outcome:		e specify below) (Bioaccumulation)	ot Applicable (e	.g., rungi of argae studies) of Not Reported				
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CAS							
Chemical.	12172-73-5)							
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 5: Outcome A	ssessment		6					
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi tion of asbestos dosed margarine.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.				
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.				
Domain 6: Confoundin	ng / Variable Co	ntrol						
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions-the study did not report if the rats were acclimated to test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Presen	ntation and Anal	ysis						
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.				
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.				

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary							
Taxa, Species, Age: Health Outcome: Chemical:	Gastrointesti	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported Gastrointestinal asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172 73 5)							
HERO ID:	3615355								
Domain		Metric	Rating	Comments					
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.					
	Metric 2:	Test Substance Source	Low	The cost substances were identified by name only. The source of the chrysotile, crocidolite, and amosite was not reported, nor were they analytically verified.					
	Metric 3:	Test Substance Purity	Medium	The chrysotile, crocidolite, and amosite were all reported as UICC standard references, and thus they met some standards.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Negative controls were reported to be used in each portion of the study.					
	Metric 5:	Negative Control Response	High	The response of the negative controls was reported in the text under the "results" sec- tion.					
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.					
Domain 3: Exposure Ch	aracterization								
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail–the three different asbestos fibers were mixed in margarine at 5mg asbestos per 1g of margarine, so each rat was getting approximately 250-300mg asbesto per rat.					
	Metric 8:	Consistency of Exposure Administration	High	Rats were fed margarine dosed with a particular asbestos fiber at a dose of approxi- mately 250-300mg of asbestos per rat. Rats were given the margarine ad libitum along with a pelleted diet. Exposures were administered consistently across study groups.					
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the asbestos concentrations were measured.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration for each experiment was 1 year or less of exposure.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the pathological response of the gastrointestinal tract to 3 different asbestos fibers.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble fiber, and the exposure was via diet.					
Domain 4: Test Organisi	m								
Somen i. Tost organis	Metric 13:	Test Organism Characteristics	Medium	The source of the rats was not reported. The rats were Male SPF Han rats that were reported to be 10wks of age at the start of the test.					
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether the rats were acclimated to test conditions.					
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	In the first and third experiments there were 4 rats for each asbestos fiber and 2 controls. In the second experiment there were 2 rats per fiber type and a control.					

		contin	ued from previ	ous page				
Study Citation: Duration: Exposure Route, Media, Path:	Bolton, R. E., Davis, J. M. (1976). The short-term effects of chronic asbestos ingestion in rats. Annals of Occupational Hygiene 19(2):121-128. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary							
Taxa, Species, Age:	Vertebrate: N	Aammalian; Rattus norvegicus; SPF Han; N	ot Applicable (e	a fungi or algae studies) or Not Reported				
Health Outcome:	Gastrointesti		or applicable (e	.g., rungi of algae studies) of Not Reported				
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-crocidolite (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (
Chemieun	12172-73-5)							
HERO ID:	3615355							
Domain		Metric	Rating	Comments				
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to the maintenance of health, and biomass loading was appropriate. Rats were housed with two rats per cage. They were fed a standard laboratory rat pellet diet with the addi- tion of asbestos dosed margarine.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest-changes in the gastrointestinal tract due to asbestos fibers.				
	Metric 18:	Consistency of Outcome Assessment	Medium	All groups were assessed the same for each experiment except for chrysotile in the ash- ing analysis. This was due to acid susceptibility of chrysotile.				
Domain 6: Confounding	Variable Co	atral						
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions–the study did not report if the rats were acclimated to test conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.				
Domain 7: Data Present	ation and Anal	vsis						
	Metric 21:	Statistical Methods	High	A Poisson distribution was assumed in order to conduct comparisons between fibers.				
	Metric 22:	Reporting of Data	Low	Data for exposure related findings was described in the text.				
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Statistics were reported to be performed, but there were no measures of variability re- ported. However, the study was primarily on pathological effects of asbestos on the gastrointestinal tract.				
Additional Comments:		for Amosite; Exposure duration 2-52 Weel nal tract ,Lymph node, Small intestine).	x(s); Study Dura	tion 1 Year(s); Cellular (Cell(s)-Cell changes, Organelle changes, Response Site				
Overall Qualit	ty Detern	nination	Medium					

l Dura trial; F rate; N r/Carc	on and Toxicology 6(4):507-513. ation: > 21 days; Exposure Duration: > 21 Food/Diet; Dietary Mammalian; <i>Rattus norvegicus</i> ; Wistar; Not inogenesis erpentine) (CASRN 12001-29-5) Metric Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response Randomized Allocation	·	Comments The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
arial; F rate; M r/Carc tile (so 57 1: 2: 3: 4: 5:	Good/Diet; Dietary Mammalian; <i>Rattus norvegicus</i> ; Wistar; Not inogenesis erpentine) (CASRN 12001-29-5) <u>Metric</u> Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Applicable (e.g. Rating Low High Low	Comments The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
rate; M tr/Carc tile (so 57 1: 2: 3: 4: 5:	Mammalian; <i>Rattus norvegicus</i> ; Wistar; Not inogenesis erpentine) (CASRN 12001-29-5) <u>Metric</u> Test Substance Identity Test Substance Source <u>Test Substance Purity</u> Negative Controls Negative Control Response	Rating Low High Low High High	Comments The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
<pre>//Carc tile (se 57 1: 2: 3: 4: 5:</pre>	inogenesis erpentine) (CASRN 12001-29-5) <u>Metric</u> Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Rating Low High Low High High	Comments The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
<pre>//Carc tile (se 57 1: 2: 3: 4: 5:</pre>	inogenesis erpentine) (CASRN 12001-29-5) <u>Metric</u> Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Rating Low High Low High High	Comments The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
tile (so 57 1: 2: 3: 4: 5:	Metric Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Low High Low High High	The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
1: 2: 3: 4: 5:	Metric Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Low High Low High High	The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
1: 2: 3: 4: 5:	Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Low High Low High High	The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
2: 3: 4: 5:	Test Substance Identity Test Substance Source Test Substance Purity Negative Controls Negative Control Response	Low High Low High High	The chemical was identified by name only. The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
2: 3: 4: 5:	Test Substance Source Test Substance Purity Negative Controls Negative Control Response	High Low High High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
2: 3: 4: 5:	Test Substance Source Test Substance Purity Negative Controls Negative Control Response	High Low High High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
3: 4: 5:	Test Substance Purity Negative Controls Negative Control Response	Low High High	Grade No. 7RF02. Purity or grade of test substance were not reported. Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
4: 5:	Negative Controls Negative Control Response	High High	Study authors reported using an appropriate concurrent negative control group. The biological response of the negative control group was reported and reasonable for assessed outcomes.
5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	<u> </u>	-	assessed outcomes.
6:	Randomized Allocation	Low	
		LOW	Researchers did not report how organisms were allocated to study groups.
ation			
7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
-	Preparation		
8:	Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
9:	Administration Measurement of Test Substance	Low	Experience concentrations were not measured
9.	Concentration	LOW	Exposure concentrations were not measured.
10:	Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
11:	Number of Exposure Groups/	N/A	Only one concentration was used.
	Spacing of Exposure Levels		·, · · · ·
12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
12.	Test Organism Characteristics	11:-1-	
	e	0	The test organisms were adequately described and were obtained from a reliable source
14:		LOW	The study did not report whether test organisms were acclimatized.
15:		Low	Downgraded due to using only 10 organisms without the use of replicates.
10.	8	Low	Downgraded due to using only 10 organisms whilout the use of repredees.
	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organis health.
	Conti	nued on nevt no	000
	13: 14: 15:	 14: Acclimatization and Pretreatment Conditions 15: Number of Organisms and Replicates per Group 16: Adequacy of Test Conditions 	14: Acclimatization and Pretreatment Low Conditions Conditions 15: Number of Organisms and Low Replicates per Group

		collu	nued from previo	us page				
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.							
Duration:		tion: > 21 days; Exposure Duration: > 21	days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary	-					
Media, Path:		•						
Taxa, Species, Age:	Vertebrate; N	Aammalian; Rattus norvegicus; Wistar; No	t Applicable (e.g.,	fungi or algae studies) or Not Reported				
Health Outcome:	Cancer/Carc	inogenesis						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)							
HERO ID:	3101157							
Domain		Metric	Rating	Comments				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	. / Variable Cou	atrol						
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
	Wette 17.	Design and Procedures	Low	conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.				
Domain 7: Data Present		-	_					
	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.				
Additional Comments:	This is for ex	xperiment 1.						
Overall Qualit	ty Detern	nination	Medium					

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Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental
-	Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route ,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Subst				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Desig	m			
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure	Characterization			
2 oniun of Enposere	Metric 7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
	Metric 8:	Preparation Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organ	nism			
Domain 1. Test orga	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
Domain 5: Outcome	Assessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	nge

continued from previous page				
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days			
Exposure Route,	Terrestrial; Food/Diet; Dietary			
Media, Path:				
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported			
Health Outcome:	Cancer/Carcinogenesis			
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)			
HERO ID:	3101157			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups
Domain 6: Confounding	g / Variable Cor	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:	This is for experiment 2.			
Overall Quality Determination			Medium	

Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Substa				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Desigr	l			
-	Metric 4:	Negative Controls	High	Study authors reported using 2 concurrent negative control groups, molasses and corn oil. Later they combined values.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported. It was downgraded because all organs contained asbestos.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure C	haracterization			
Domain 5. Exposure C	Metric 7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
		Preparation		
	Metric 8:	Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Administration Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was used
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.
	Weute 12.	Testing at of Below Solubility Ellint	10/21	
Domain 4: Test Organi	sm			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
		Replicates per Gloup		
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	

		conti	nued from previo	us page		
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental					
	Contamination and Toxicology 6(4):507-513.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:						
Taxa, Species, Age:		Mammalian; Rattus norvegicus; Wistar; Not	Applicable (e.g.,	fungi or algae studies) or Not Reported		
Health Outcome:	· · · · · · · · · · · · · · · · · · ·	transformation)				
Chemical:	-	erpentine) (CASRN 12001-29-5)				
HERO ID:	3101157					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment				
Domain 6: Confounding						
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veic				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	Medium	Authors did not address the asbestos levels found in control organs.		
	Meure 25.	Explanation of Onexpected Outcomes	Medium	Authors did not address the aspestos ievers found in control organs.		
Additional Comments:	This is for ex	xperiment 3.				
Overall Qualit	ty Detern	nination	Medium			

Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Substa				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Design	L			
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure C	haracterization			
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided few details on exposure media preparation.
	Metric 8:	Consistency of Exposure Administration	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organi	sm			
2 onnam 11 1000 organi	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	ige

		contin	nued from previo	us page		
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental					
	Contamination and Toxicology 6(4):507-513.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Aammalian; Rattus norvegicus; Wistar; Not	Applicable (e.g.,	fungi or algae studies) or Not Reported		
Health Outcome:	Mortality					
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)				
HERO ID:	3101157					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment	-			
Domain 6: Confounding	-		_			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	metric 25.	Explanation of Onexpected Outcomes	Ingn	Onexpected outcomes were satisfactority explained.		
Additional Comments:	This is for ex	speriment 1.				
Overall Qualit	ty Detern	nination	Medium			

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Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Substa				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Design	L			
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure C	haracterization			
	Metric 7:	Experimental System/Test Media Preparation	Low	The study provided few details on exposure media preparation.
	Metric 8:	Consistency of Exposure Administration	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organi	sm			
2 onnam 11 1000 organi	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	ige

		contin	nued from previo	us page		
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental					
	Contamination and Toxicology 6(4):507-513.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:						
Taxa, Species, Age:		Aammalian; Rattus norvegicus; Wistar; Not	Applicable (e.g.,	fungi or algae studies) or Not Reported		
Health Outcome:	Mortality					
Chemical:		erpentine) (CASRN 12001-29-5)				
HERO ID:	3101157					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups		
		Assessment				
Domain 6: Confounding			Ŧ			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	metric 25.	Explanation of Chexpected Outcomes	ingn	Chexpected outcomes were substactoring explained.		
Additional Comments:	This is for ex	xperiment 2.				
Overall Quali	tv Detern	nination	Medium			

Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental
	Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Subst	tance			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Desig	gn			
c c	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure	Characterization			
	Metric 7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
		Preparation		
	Metric 8:	Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
		Administration		
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was used.
		Spacing of Exposure Levels		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organ	nism			
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	Downgraded due to using only 10 organisms without the use of replicates.
	Metrie 15.	Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
Domain 5: Outcome	Assassment			
Domain 5: Outcome	Assessment Metric 16:	A deguage of Test Conditions	Uiah	Equipmental conditions of the test system was conducive to mainten and the second
		Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	ige

		conti	nued from previo	us page		
Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental					
	Contamination and Toxicology 6(4):507-513.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:		Aammalian; Rattus norvegicus; Wistar; Not	Applicable (e.g.,	fungi or algae studies) or Not Reported		
Health Outcome:	Developmen					
Chemical:	•	erpentine) (CASRN 12001-29-5)				
HERO ID:	ID: 3101157					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.		
		Assessment	-			
Domain 6: Confounding			_			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures	16 V	conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veie				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 22:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	Wieute 25.	Explanation of Onexpected Outcomes	Ingli	Onexpected outcomes were satisfactority explained.		
Additional Comments:	This is for ex	xperiment 1.				
Overall Qualit	ty Detern	nination	Medium			

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Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental
	Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Subst				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Desig	m			
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure	Characterization			
2 oniun of Enposere	Metric 7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
	Metric 8:	Preparation Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organ	nism			
Domain 1. Test orga	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Downgraded due to using only 10 organisms without the use of replicates.
Domain 5: Outcome	Assessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	nge

		contin	nued from previo	us page		
Study Citation:	-		Pontefract, R. D.	(1977). Chronic effects of ingested asbestos in rats. Archives of Environmental		
D		on and Toxicology 6(4):507-513.				
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Developmen					
Chemical:		erpentine) (CASRN 12001-29-5)				
HERO ID:	3101157					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups		
		Assessment				
Domain 6: Confounding			-			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	M	Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	veic				
Domain 7. Data Present	Metric 21:	Statistical Methods	Low	Statistical analysis was performed but not described adequately.		
	Metric 21: Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 22. Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
	Metho 25:	Explanation of Onexpected Outcomes	підіі	Onexpected outcomes were satisfactority explained.		
Additional Comments:	This is for ex	xperiment 2.				
Overall Qualit	ty Detern	nination	Medium			

Study Citation:	Cunningham, H. M., Moodie, C. A., Lawrence, G. A., Pontefract, R. D. (1977). Chronic effects of ingested asbestos in rats. Archives of Environmental Contamination and Toxicology 6(4):507-513.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3101157

Domain		Metric	Rating	Comments
Domain 1: Test Substa				
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source of asbestos was reported as, Johns-Manville Company, Asbestos, Quebec, Grade No. 7RF02.
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance were not reported.
Domain 2: Test Design	1			
-	Metric 4:	Negative Controls	High	Study authors reported using 2 concurrent negative control groups, molasses and corn oil. Later they combined values.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported. It was downgraded because all organs contained asbestos.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure (horostarization			
Domain 5. Exposure C	Metric 7:	Experimental System/Test Media	Low	The study provided few details on exposure media preparation.
	incure /.	Preparation	2011	The stady provided for details on exposure media preparation.
	Metric 8:	Consistency of Exposure	Medium	Ad libitum feeding always has some uncertainty regarding consistency.
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was used
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organ	iam			
Domain 4. Test Organ	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and	Low	Downgraded due to using only 10 organisms without the use of replicates.
		Replicates per Group		
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
		Conti	nued on next pa	nge

		conti	nued from previo	us page
Study Citation:			Pontefract, R. D.	(1977). Chronic effects of ingested asbestos in rats. Archives of Environmental
-		on and Toxicology 6(4):507-513.		
Duration:		ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,	Terrestrial; I	Food/Diet; Dietary		
Media, Path:				
Taxa, Species, Age:		Aammalian; Rattus norvegicus; Wistar; Not	t Applicable (e.g.,	fungi or algae studies) or Not Reported
Health Outcome:	Developmen			
Chemical:	. .	erpentine) (CASRN 12001-29-5)		
HERO ID:	3101157			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment	-	
Domain 6: Confounding				
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
		Design and Procedures		conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7. Data Dragant	ation and Anal	vaia		
Domain 7: Data Present	Metric 21:	-	Low	
		Statistical Methods	Low	Statistical analysis was performed but not described adequately.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Authors did not address the asbestos levels found in control organs.
Additional Comments:	This is for early	xperiment 3.		
Overall Qualit	ty Deterr	nination	Medium	

Study Citation:			R. (1980). The e	ffects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(
	Suppl):1073		1	
Duration:		ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,	Terrestrial; I	Food/Diet; Dietary		
Media, Path:	Vartabrata	Mammalian: Pattus nomeniaus: Eishor 244	SDE stools Invo	nila
Taxa, Species, Age:		Mammalian; <i>Rattus norvegicus</i> ; Fisher 344,	SPF Slock; Juvel	mie
Health Outcome: Chemical:	Cancer/Carc	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802	(CASKIV 12001-29-5)		
	5010002	Metric	Dating	Comments
Domain Domain 1: Test Substand	CP.	Metric	Rating	Comments
Domain 1. Test Substan	Metric 1:	Test Substance Identity	Low	Chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source was stated.
	Metric 3:	Test Substance Purity	Medium	Cited references provided characterization of the asbestos.
	Weute 5.	Test Substance Fully	Weddulli	ched references provided characterization of the assessos.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	There were two control groups (cellulose diet and standard laboratory diet).
	Metric 5:	Negative Control Response	Medium	Biological responses of controls were shown in Figure 1, with positive tumor results described in Table 1, and lesion results shown in Table 2. The number of tumors in standard laboratory diet control equaled that of the asbestos treatment.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
	Metric 7:	Experimental System/Test Media Preparation	High	Details were provided on how asbestos was incorporated into the feed.
	Metric 8:	Consistency of Exposure Administration	Low	Details were lacking of how much feed was provided (vs free-feeding) and how often feed was provided/changed.
	Metric 9:	Measurement of Test Substance	Low	The exposure concentration was not measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported (6 months-32 months) and suitable for the study type (chronic).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested (10% asbestos in feed).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	High	Common name, strain, source, and age were stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Rats were acclimated for 1 week before conducting experiments.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	Asbestos treatment contained 240 rats, fiber control group contained 242 rats, and star dard laboratory diet group contained 121 rats.
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.
		Conti	nued on next pa	
		1	Page 301 of 419	8

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		····contin	iucu nom previo	as page
Study Citation:	Donham, K. Suppl):1073-		R. (1980). The eff	fects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5
Duration:		ation: > 21 days; Exposure Duration: > 21	days	
Exposure Route,		Food/Diet; Dietary	2	
Media, Path:		· ·		
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fisher 344,	SPF stock; Juveni	ile
Health Outcome:	Cancer/Carc	inogenesis		
Chemical:		erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	The outcome methodology was well described.
	Metric 18:	Consistency of Outcome Assessment	High	Observations were made at 6, 7, and 8 months of exposure with routine sampling. From then on to the end of the study (32 months exposure), sacrifice was made only for the rats that were noticeably ill/dying, with the remaining rats sacrificed at 32 months.
Domain 6: Confounding	g / Variable Cor	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Medium	Treated rats were kept in a different room than control rats (presumably to limit asbestos exposure to control rats). However, both rooms seemed to contain the same environmental conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	High	Statistical methods were adequately explained.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for asbestos-treated and control groups in Figure 2, Table 1, and Table 2.
	Metric 23:	Explanation of Unexpected Outcomes	High	The unexpected outcome (high incidence of colon tumors in one of the control groups) was satisfactorily explained by the authors.
Additional Comments:	This form al	so applies to the preliminary IP experiment.		
Overall Qualit	ty Detern	nination	Medium	

Study Citation:	Donham, K. Suppl):1073		R. (1980). T	The effects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5				
Duration:		ation: Not-reported; Exposure Duration: >	> 21 days					
Exposure Route,		Food/Diet; Dietary	•					
Media, Path:								
Taxa, Species, Age:	Vertebrate; 1	Mammalian; Rattus norvegicus; Fisher 344	4, SPF stock; J	Juvenile				
Health Outcome:	ADME (bio	transformation)						
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)						
HERO ID:	3616802	-						
Domain		Metric	Rating	Comments				
Domain 1: Test Substan								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.				
	Metric 2:	Test Substance Source	High	The source was stated.				
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.				
Domain 2: Test Design								
Ũ	Metric 4:	Negative Controls	High	Two control groups were included in the study.				
	Metric 5:	Negative Control Response	Medium	Several of the control rats had fibers in tissues of their colon. Also it's not clear as to				
		с ,		fiber load per section of tissue as this was not reported by the authors.				
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.				
Domain 3: Exposure Ch	aracterization							
	Metric 7:	Experimental System/Test Media Preparation	High	Details were provided on how asbestos was incorporated into the feed.				
	Metric 8:	Consistency of Exposure Administration	Low	Details were lacking of how much feed was provided (vs free-feeding) and how often feed was provided/changed.				
	Metric 9:	Measurement of Test Substance	Low	Exposure concentration was not measured.				
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	The duration of exposure was reported (24 months) and suitable for the study type. It was not explicitly stated when study was ended.				
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.				
		Spacing of Exposure Levels						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.				
Domain 4: Test Organis	m							
-	Metric 13:	Test Organism Characteristics	High	Common name, strain, source, and age were stated.				
	Metric 14:	Acclimatization and Pretreatment	High	Rats were acclimated for 1 week prior to conducting experiments.				
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Ten rats in both the asbestos and cellulose control group were included in the study. Six rats were included in the standard laboratory diet control group.				
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome methodology was adequately described.				
		Cont	tinued on nex	rt nage				

Study Citation:	Donham, K. Suppl):1073		R. (1980). T	The effects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5
Duration:		ation: Not-reported; Exposure Duration: >	21 days	
Exposure Route,		Food/Diet; Dietary	21 duy5	
Media, Path:	Terresului, T	ood Diet, Dietary		
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; Fisher 344,	SPF stock:	Juvenile
Health Outcome:		transformation)	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Low	It is unclear when the study was terminated or when the rats were sacrificed (it was stated that rats were switched to a normal diet at least 30 days before their death or the termination of the study).
Domain 6: Confounding	g / Variable Con Metric 19:	ntrol Confounding Variables in Test Design and Procedures	Medium	It is unclear how long rats in the asbestos and cellulose groups were on the standard diet prior to sacrifice/death.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Present	ation and Anal	veis		
Domain 7: Data Frederic	Metric 21:	Statistical Methods	N/A	The study focused on pathology findings.
	Metric 22:	Reporting of Data	Low	Data was presented as absence or presence of fibers in the colon tissue. Fiber load was not presented.
	Metric 23:	Explanation of Unexpected Outcomes	High	The unexpected outcome (presence of fibers in colon of control rats) was satisfactorily explained as contamination with a different type of material since fiber length did not match UICC chrysotile.
Additional Comments:	Lesions were	e documented.		

Study Citation:	Donham, K. Suppl):1073		R. (1980). The e	ffects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(
Duration:	Overall Dura	ation: Not-reported; Exposure Duration: > 2	21 days	
Exposure Route,	Terrestrial; I	Food/Diet; Dietary		
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fisher 344,	SPF stock; Juver	nile
Health Outcome:	Mechanistic	-Cell signaling/function-Kidney/renal		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
Domain 1: Test Substan	ce			
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The source was stated.
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.
Domain 2: Test Design				
U	Metric 4:	Negative Controls	High	Two control groups were included in the study.
	Metric 5:	Negative Control Response	Medium	The biological response of the control groups is shown in Figures 4 (cAMP) and 5
		с .		(cGMP) and appears reasonable for cAMP. There was no explanation provided for wh
				standard laboratory diet control response was equal to that of asbestos group for cGMI
				whereas the cellulose control group had an order of magnitude greater level of cGMP.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
•	Metric 7:	Experimental System/Test Media	High	Details were provided on how asbestos was incorporated into the feed.
		Preparation		
	Metric 8:	Consistency of Exposure	Low	Details were lacking of how much feed was provided (vs free-feeding) and how often
		Administration		feed was provided/changed.
	Metric 9:	Measurement of Test Substance	Low	Exposure concentration was not measured.
	Matria 10:	Concentration	IIIah	
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported (24 months) and suitable for the study type. Th study was terminated when rats were 33 months of age.
	Metric 11:	Number of Exposure Groups/	N/A	One concentration was tested.
	meule 11.	Spacing of Exposure Levels	11/71	One concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organis		Test Organism Charles is it	TT' 1	
	Metric 13:	Test Organism Characteristics	High	Common name, strain, source, and age were stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Rats were acclimated for 1 week before conducting experiments.
	Metric 15:	Number of Organisms and	Low	Although there were 36 and 30 rats used in asbestos and cellulose control groups, re-
		Replicates per Group		spectively, only 6 rats were included in the standard laboratory diet control group for
				analysis of cAMP. Similarly, 7, 30, and 4 rats were included in asbestos, cellulose, and
				standard laboratory diet control groups for analysis of cGMP.

Continued on next page ...

Study Citation:				
Study Churchen	Donham, K. Suppl):1073-		R. (1980). The eff	ects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5
Duration:		tion: Not-reported; Exposure Duration: >	21 days	
Exposure Route,		Food/Diet; Dietary	21 duy5	
Media, Path:	Terrestitui, T	ood Diet, Dietaly		
Taxa, Species, Age:	Vertebrate; N	Aammalian; Rattus norvegicus; Fisher 344.	, SPF stock; Juveni	le
Health Outcome:	Mechanistic-	Cell signaling/function-Kidney/renal		
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.
	Metric 17:	Outcome Assessment Methodology	Medium	The radioimmunoassay technique was lacking in detail past the vendor.
	Metric 18:	Consistency of Outcome	Medium	Rats were terminated at 33 months of age. Presumably, the weanlings were 1 month of
		Assessment		age when the study commenced, but this was not explicitly stated.
Domain & Confoundin	a / Variabla Car	ates		
Domain 6: Confoundin	Metric 19:	Confounding Variables in Test	Medium	Treated rats were kept in a different room than control rats (presumably to limit asbesto
	Metric 19.	Design and Procedures	Wiedium	exposure to control rats). However, both rooms seemed to contain the same environment tal conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	
		Succomes concluted to Exposure		There was no information in the study to suggest differences among groups.
Domain 7: Data Presen	tation and Analy	*		There was no information in the study to suggest differences among groups.
Domain 7: Data Presen	tation and Anal Metric 21:	*	Uninformative	
Domain 7: Data Presen		ysis	Uninformative High	It does not appear that statistics were conducted. Data for exposure-related findings were presented for each treatment and control group
Domain 7: Data Presen	Metric 21:	ysis Statistical Methods		It does not appear that statistics were conducted. Data for exposure-related findings were presented for each treatment and control group in Figures 4 and 5.
Domain 7: Data Presen Additional Comments:	Metric 21: Metric 22:	ysis Statistical Methods Reporting of Data Explanation of Unexpected Outcomes	High	It does not appear that statistics were conducted. Data for exposure-related findings were presented for each treatment and control group in Figures 4 and 5. Variability of the data was shown in Figures 4 and 5. There was no explanation provided by authors of why cGMP levels were equal between asbestos and one of the control

Study Citation: Duration:	Donham, K. J., Berg, J. W., Will, L. A., Leininger, J. R. (1980). The effects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5 Suppl):1073-1084. Overall Duration: > 21 days; Exposure Duration: > 21 days								
Exposure Route,	Terrestrial; I	Terrestrial; Food/Diet; Dietary							
Media, Path:									
Taxa, Species, Age:	Vertebrate; I	Mammalian; Rattus norvegicus; Fisher 344,	SPF stock; Juver	ile					
Health Outcome:	Developmer	Development/Growth							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)							
HERO ID:	3616802								
Domain		Metric	Rating	Comments					
Domain 1: Test Substand									
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The source was stated.					
	Metric 3:	Test Substance Purity	Medium	Cited references provided characterization of the asbestos.					
Domain 2: Test Design									
voit 2 voigit	Metric 4:	Negative Controls	High	Two control groups were included in the study.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Figure 1 and it					
			-	was reasonable for assessed outcomes.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 3: Exposure Ch	aracterization								
· · · · · · ·	Metric 7:	Experimental System/Test Media	High	Details were provided on how asbestos was incorporated into the feed.					
		Preparation	U	1 1					
	Metric 8:	Consistency of Exposure	Low	Details were lacking of how much feed was provided (vs free-feeding) and how often					
		Administration		feed was provided/changed.					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
	Metric 10:	Concentration	Iliah	Free sure donation must for the					
		Exposure Duration and Frequency	High	Exposure duration was 6 weeks.					
	Metric 11:	Number of Exposure Groups/	High	Five doses were tested (1-20% asbestos in diet).					
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.					
	Methe 12.	Testing at of Delow Solubility Ennit	10/1						
Domain 4: Test Organisi									
	Metric 13:	Test Organism Characteristics	High	Common name, strain, source, and age were stated.					
	Metric 14:	Acclimatization and Pretreatment	High	Rats were acclimated for 1 week before conducting experiments.					
	Matria 15.	Conditions	Madium						
	Metric 15:	Number of Organisms and Replicates per Group	Medium	Ten rats per treatment group, 10 rats per cellulose control group, and 20 standard diet control rats were utilized in the experiment.					
		Replicates per Group		condorrats were dunzed in the experiment.					
Domain 5: Outcome Ass	sessment								
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.					
	Metric 17:	Outcome Assessment Methodology	Medium	Weight gain was determined at 6 weeks with initial weight presumably taken at the star of study (this was not stated). Total weight was not stated.					
	Metric 18:	Consistency of Outcome	Low	Not explicitly stated when the rats were weighed. Figure 1 legend indicates weight gain					
		Assessment		was determined at 6 weeks of exposure.					
		Conti	nued on next pa	π <u>α</u>					

			nucu nom previo	
Study Citation:			R. (1980). The eff	ects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5
Duration:	Suppl):1073	-1084. ation: > 21 days; Exposure Duration: > 21	davs	
Exposure Route,		Food/Diet; Dietary	days	
Media, Path:	Terrestitui, T	ood Diet, Dietaly		
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fisher 344,	SPF stock; Juveni	le
Health Outcome:	Developmen	_		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
	Metric 19:	Confounding Variables in Test Design and Procedures	Medium	Treated rats were kept in a different room than control rats (presumably to limit asbesto exposure to control rats). However, both rooms seemed to contain the same environment tal conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Presenta	ation and Anal	ysis		
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.
	Metric 22:	Reporting of Data	Medium	Sex-specific average weight gain per treatment group was presented in Figure 1. Total body weights were not reported at the beginning and start of the study. There was minimal discussion in text of the results (discussion found in methods section).
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals)
Additional Comments:	None			
Overall Qualit		•	Low	

Study Citation:	Donham, K. J., Berg, J. W., Will, L. A., Leininger, J. R. (1980). The effects of long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5 Suppl):1073-1084.								
Duration:		Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,		Terrestrial; Food/Diet; Dietary							
Media, Path:		· · ·							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fisher 344, SP	PF stock; Juvenile						
Health Outcome:	Cancer/Carc	inogenesis							
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)							
HERO ID:	3616802								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	ce								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The source was stated.					
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.					
Domain 2: Test Design									
C	Metric 4:	Negative Controls	High	Control rats were either gavaged or injected with DI water.					
	Metric 5:	Negative Control Response	Medium	Authors stated no lesions found in the control rats. It is unclear if this included observa- tion of mesothelioma.					
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.					
Domain 3: Exposure Ch									
	Metric 7:	Experimental System/Test Media Preparation	Low	There were minimal details on preparation of asbestos slurry in water.					
	Metric 8:	Consistency of Exposure Administration	Low	Presumably all rats were gavaged or injected on the same day, but that was not explicit stated.					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
	Metric 10:	Concentration Exposure Duration and Frequency	Medium	Animals were presumably gavaged or IP injected a single time and observations noted 4-8 months after exposure, but this was not explicitly stated.					
	Metric 11:	Number of Exposure Groups/	High	Three asbestos doses were used: 5.9 mg, 17.1 mg, and 29.4 mg.					
		Spacing of Exposure Levels							
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via gavage and IP injection.					
Domain 4: Test Organis	m								
c	Metric 13:	Test Organism Characteristics	High	Common name, strain, source, and age were stated.					
	Metric 14:	Acclimatization and Pretreatment	High	Rats were acclimated for 1 week before conducting experiments.					
	Metric 15:	Conditions Number of Organisms and	Low	Twenty-six rats were gavaged with asbestos (authors stated they were divided into thre					
		Replicates per Group		equal groups; one group per dose), 18 rats were injected with asbestos (authors stated they were divided into three equal groups; one group per dose), 3 control rats were gav aged with DI water, and 2 control rats were injected with DI water. The number of rats per treatment group in the asbestos gavage is confusing. The number of control rats is lower than that used in the treatment groups.					

Domain 5: Outcome Assessment

Continued on next page ...

		co	ontinued from previous	page
Study Citation:	Donham, K. Suppl):1073		(1980). The effects of l	long-term ingestion of asbestos on the colon of F344 rats. Cancer 45(5
Duration:		ation: > 21 days; Exposure Duration: > 21 d	ays	
Exposure Route,		Food/Diet; Dietary	5	
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fisher 344, S	PF stock; Juvenile	
Health Outcome:	Cancer/Carc			
Chemical:	•	erpentine) (CASRN 12001-29-5)		
HERO ID:	3616802			
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.
	Metric 17:	Outcome Assessment Methodology	Low	No details were provided as to how the authors determined mesotheliomas or gastric lesions.
	Metric 18:	Consistency of Outcome Assessment	Low	It was not explicitly stated when the experiment ended. Observations were made be- tween 4-8 months post-treatment.
Domain 6: Confounding	g / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Medium	Treated rats were kept in a different room than control rats (presumably to limit asbestor exposure to control rats). However, both rooms seemed to contain the same environmental conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.
Domain 7: Data Presenta	ation and Anal	vsis		
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.
	Metric 22:	Reporting of Data	Uninformative	Dose-specific effects were not stated. Instead, results in the text were presented as asbestos-treated vs control.
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals)
Additional Comments:	This form al	so applies to the preliminary IP experiment.		

Overall Quality Determination

Uninformative

Study Citation:		, F. M., Burger, B. F. (1973). Biological effect	ct of asbestos dust on the	e peritoneal viscera of rats. South African Medical Journal 47(38):1746-
Duration:	1750. Overall Dura	ation: > 21 days; Exposure Duration: > 21 d	lavs	
Exposure Route,		V/A (e.g., injection); Injection	<i>u</i> , <i>s</i>	
Media, Path:	Terrestriar, 1	(i.g., injection), injection		
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; Not Applical	ble (e.g., fungi or algae st	udies) or Not Reported
Health Outcome:	Cancer/Carc		8	
Chemical:		riebeckite) (CASRN 12001-28-4)		
HERO ID:	3619879			
Domain		Metric	Rating	Comments
Domain 1: Test Substand				
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile and the crocidolite were not reported.
	Metric 3:	Test Substance Purity	Medium	Both the chrysotile and the crocidolite were reported as UICC standard reference as- bestos samples, so they were held to a standard.
Domain 2: Test Design				
U	Metric 4:	Negative Controls	Uninformative	The study did not report the use of negative controls.
	Metric 5:	Negative Control Response	Low	The study did not report the use of a negative control, and therefore did not report a negative control response.
	Metric 6:	Randomized Allocation	Medium	The rats were reported to be randomly divided into two study groups.
Domain 3: Exposure Ch	aracterization			
2 011411 01 2.1905410 01	Metric 7:	Experimental System/Test Media Preparation	High	The chrysotile and crocidolite particles were suspended in saline solution at 50mg/mL and injected into the abdominal cavity of the rats.
	Metric 8:	Consistency of Exposure Administration	Medium	Details of exposure administration were reported in some detail. All rats were injected with 1mL of the 50mg/mL suspension of asbestos along with 1mL of air. The timing of when the animals received the injection was not reported.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report if the test substances were measured.
	Metric 10:	Exposure Duration and Frequency	High	This study was described as a survival experiment and went for the duration of the rats' lives.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the response of the rats to either chrysotile or crocidolite injected into the abdominal cavity
	Metric 12:	Testing at or Below Solubility Limit	N/A	Chrysotile and crocidolite are insoluble chemicals.
Domain 4: Tost Orcania	~			
Domain 4: Test Organis		Test One niem Chanset sisting	I	
	Metric 13:	Test Organism Characteristics	Low	The rats were female albinos, but the source of the rats and the age of the rats were not reported.
	Metric 14:	Acclimatization and Pretreatment	Low	It was not reported whether the rats were acclimated to test conditions.
	Metric 15:	Conditions Number of Organisms and	Low	There were 10 animals per treatment. This is lower than numbers typically used in thes
		Replicates per Group		tests.

Continued on next page ...

Study Citation:	•	Engelbrecht, F. M., Burger, B. F. (1973). Biological effect of asbestos dust on the peritoneal viscera of rats. South African Medical Journal 47(38):1746-					
	1750.						
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ys				
Exposure Route,	Terrestrial; N	N/A (e.g., injection); Injection					
Media, Path:	X7 / 1 / X						
Taxa, Species, Age: Health Outcome:		Mammalian; <i>Rattus norvegicus</i> ; Not Applicabl	e (e.g., fungi or algae	studies) or Not Reported			
Chemical:	Cancer/Carc	riebeckite) (CASRN 12001-28-4)					
HERO ID:	3619879	nebeckile) (CASKIN 12001-28-4)					
Domain		Metric	Rating	Comments			
Domain 5: Outcome As	ssessment						
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions, food, and water conditions were not sufficiently reported to evaluate if they were adequate. Housing was not described either.			
	Metric 17:	Outcome Assessment Methodology	Low	There was minimal description on histological examination for tumors.			
	Metric 18:	Consistency of Outcome Assessment	High	Animals were assessed daily for signs and symptoms of abdominal tumors. Once ascite developed, the rat was killed and the abdominal organs were inspected. Tissue was take for histological examination.			
Domain 6: Confounding	g / Variable Cou	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	tation and Anal	vsis					
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and therefore no statistics were performed.			
	Metric 22:	Reporting of Data	Medium	Pathological results for each asbestos fiber were reported in the text and in Figures 1- 7 for treatment only. No control group was reported and no results for controls were shown.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.			

Overall Quality Determination

Uninformative

Asbestos

Study Citation:	Engelbrecht, 1750.	, F. M., Burger, B. F. (1973). Biological effe	ct of asbestos dust on the	e peritoneal viscera of rats. South African Medical Journal 47(38):1746-
Duration: Exposure Route, Media, Path:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 d N/A (e.g., injection); Injection	lays	
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Cancer/Carc	Mammalian; <i>Rattus norvegicus</i> ; Not Applical inogenesis erpentine) (CASRN 12001-29-5)	ble (e.g., fungi or algae st	rudies) or Not Reported
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1:	Test Substance Identity	Low	The test substances were identified by name only.
	Metric 2:	Test Substance Source	Low	The source of the chrysotile and the crocidolite were not reported.
	Metric 3:	Test Substance Purity	Medium	Both the chrysotile and the crocidolite were reported as UICC standard reference as- bestos samples, so they were held to a standard.
Domain 2: Test Design				
	Metric 4:	Negative Controls	Uninformative	The study did not report the use of negative controls.
	Metric 5:	Negative Control Response	Low	The study did not report the use of a negative control, and therefore did not report a negative control response.
	Metric 6:	Randomized Allocation	Medium	The rats were reported to be randomly divided into two study groups.
Domain 2. Europuna Ch	anastanization			
Domain 3: Exposure Cha	Metric 7:	Experimental System/Test Media	High	The chrysotile and crocidolite particles were suspended in saline solution at 50mg/mL
	Methe 7.	Preparation	Tingii	and injected into the abdominal cavity of the rats.
	Metric 8:	Consistency of Exposure Administration	Medium	Details of exposure administration were reported in some detail. All rats were injected with 1mL of the 50mg/mL suspension of asbestos along with 1mL of air. The timing of when the animals received the injection was not reported.
	Metric 9:	Measurement of Test Substance	Low	The study authors did not report if the test substances were measured.
	Metric 10:	Concentration Exposure Duration and Frequency	High	This study was described as a survival experiment and went for the duration of the rats' lives.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent response, but to observe the response of the rats to either chrysotile or crocidolite injected into the abdominal cavity.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Chrysotile and crocidolite are insoluble chemicals.
Domain 4: Test Organisi	n			
C C	Metric 13:	Test Organism Characteristics	Low	The rats were female albinos, but the source of the rats and the age of the rats were not reported.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the rats were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were 10 animals per treatment. This is lower than numbers typically used in these tests.
Domain 5: Outcome Ass	sessment			
		С	ontinued on next page .	••

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Study Citation:	Engelbrecht, F. M., Burger, B. F. (1973). Biological effect of asbestos dust on the peritoneal viscera of rats. South African Medical Journal 47(38):1746-						
	1750.	1750. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Duration:			/8				
Exposure Route,	Terrestrial; N	V/A (e.g., injection); Injection					
Media, Path:	X7 / 1 / X						
Taxa, Species, Age:		Aammalian; <i>Rattus norvegicus</i> ; Not Applicable	e (e.g., fungi or algae	studies) or Not Reported			
Health Outcome: Chemical:	Cancer/Carc	inogenesis erpentine) (CASRN 12001-29-5)					
HERO ID:	3619879	erpentine) (CASKN 12001-29-3)					
Domain	Metric		Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions, food, and water conditions were not sufficiently reported to evaluate if they were adequate. Housing was not described either.			
	Metric 17:	Outcome Assessment Methodology	Low	There was minimal description on histological examination for tumors.			
	Metric 18:	Consistency of Outcome	High	Animals were assessed daily for signs and symptoms of abdominal tumors. Once ascite			
		Assessment		developed, the rat was killed and the abdominal organs were inspected. Tissue was take for histological examination.			
Domain 6: Confounding	g / Variable Cor	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported if the rats were acclimated to test conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure.			
Domain 7: Data Present	ation and Anal	vsis					
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and therefore no statistics were performed.			
	Metric 22:	Reporting of Data	Medium	Pathological results for each asbestos fiber were reported in the text and in Figures 1- 7 for treatment only. No control group was reported and no results for controls were shown.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.			

Overall Quality Determination

Uninformative

Study Citation:			g, F. (2008). Oral	ly ingested chrysotile asbestos affects rat lungs and pleura. Archives of Environ					
		Occupational Health 63(2):71-75.	,						
Duration:		ation: > 21 days; Exposure Duration: > 21	days						
Exposure Route,	Terrestrial;	Terrestrial; Water; Dietary							
Media, Path:	Vantahnatas	Vertebrate; Mammalian; Rattus norvegicus; Wistar; Adult							
Taxa, Species, Age:		Manimanan, <i>Ranus norvegicus</i> , wistar, Au	111						
Health Outcome: Chemical:	Respiratory	amontina) (CASDN 12001 20 5)							
HERO ID:	478543	erpentine) (CASRN 12001-29-5)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substar	ice								
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.					
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.					
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.					
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.					
Domain 2: Exposure Cl	aractarization								
Domain 3: Exposure Cl	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in adequate detail.					
	Metric 8:	Preparation Consistency of Exposure Administration	Medium	Exposures were administered consistently across study groups, although quantity con- sumed per rat was not reported.					
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.					
	Matria 10.	Concentration	IIIah						
	Metric 10: Metric 11:	Exposure Duration and Frequency Number of Exposure Groups/	High High	The duration of exposure was reported and suitable for the study type.					
	Metric 11.	Spacing of Exposure Levels	nigii	The duration of exposure was reported and suitable for the study type.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.					
Domain 4: Test Organis	sm								
2 chain in 10st Organic	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source					
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.					
	Metric 15:	Conditions Number of Organisms and	Low	Replicates were not used.					
	Metrie 15.	Replicates per Group	Low						
Domain 5: Outcome As	sessment								
2 chian 51 Gutolilo I l	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.					
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology reported the intended outcome of interest, but few details were reported.					
			nued on next pa						

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Study Citation:	Hasanoglu, J	H. C., Bayram, E., Hasanoglu, A., Demirag,	F. (2008). Oral	ly ingested chrysotile asbestos affects rat lungs and pleura. Archives of Environ		
-	-	Decupational Health 63(2):71-75.		· - · · · ·		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 d	lays			
Exposure Route,	Terrestrial; V	Water; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Wistar; Adul	t			
Health Outcome:	Respiratory					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	478543					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Medium	There was incomplete reporting of minor details of outcome assessment protocol execution		
		Assessment		tion.		
Domain 6: Confounding	o / Variable Cor	ntrol				
Domain o. Contouriduig	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
				There was no information in the study to suggest unreferences among groups.		
				There was no mormation in the study to suggest unreferees among groups.		
Domain 7: Data Present	ation and Anal	<u>^</u>		There was no mormation in the study to suggest differences among groups.		
Domain 7: Data Present	tation and Anal Metric 21:	<u>^</u>	High	Statistical methods were adequately described.		
Domain 7: Data Present		ysis				
Domain 7: Data Present	Metric 21:	ysis Statistical Methods	High	Statistical methods were adequately described.		
	Metric 21: Metric 22: Metric 23:	ysis Statistical Methods Reporting of Data Explanation of Unexpected Outcomes	High High High	Statistical methods were adequately described. Data for exposure-related findings were presented for each treatment and control group Unexpected outcomes were satisfactorily explained.		
Domain 7: Data Present Additional Comments:	Metric 21: Metric 22: Metric 23:	ysis Statistical Methods Reporting of Data	High High High	Statistical methods were adequately described. Data for exposure-related findings were presented for each treatment and control group Unexpected outcomes were satisfactorily explained.		

Study Citation: Duration: Exposure Route, Media, Path:	mental and Overall Dur	H. C., Bayram, E., Hasanoglu, A., Demirag. Occupational Health 63(2):71-75. ation: > 21 days; Exposure Duration: > 21 d Water; Dietary		ly ingested chrysotile asbestos affects rat lungs and pleura. Archives of Environ-
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (bio	Mammalian; <i>Rattus norvegicus</i> ; Wistar; Adu transformation) serpentine) (CASRN 12001-29-5)	lt	
Domain		Metric	Rating	Comments
Domain 1: Test Substan			_	
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.
	Metric 2:	Test Substance Source	High	The test substance identity was analytically verified by the performing laboratory.
	Metric 3:	Test Substance Purity	Low	Purity and/or grade of test substance were not reported.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Domain 3: Exposure Ch	aracterization			
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in
		Preparation		adequate detail.
	Metric 8:	Consistency of Exposure Administration	Medium	Exposures were administered consistently across study groups, although quantity con- sumed per rat was not reported.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	High	The duration of exposure was reported and suitable for the study type.
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Tost Organis	m			
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 13: Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Number of Organisms and Replicates per Group	Low	Replicates were not used.
Domain 5: Outcome As	sessment			
Domain J. Outcome As	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology reported the intended outcome of interest, but few details were reported.
	Metric 18:	Consistency of Outcome Assessment	Medium	There was incomplete reporting of minor details of outcome assessment protocol execu- tion.
			nued on next pa	

		conti	nued from previo	is page		
Study Citation:			g, F. (2008). Orally	v ingested chrysotile asbestos affects rat lungs and pleura. Archives of Environ-		
Duration:		Decupational Health $63(2)$:71-75. ation: > 21 days; Exposure Duration: > 21	dave			
Exposure Route,		Vater; Dietary	days			
Media, Path:	Terrestriar, v	valor, Dietary				
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Rattus norvegicus</i> ; Wistar; Adu	ult			
Health Outcome:	ADME (biotransformation)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	478543					
Domain		Metric	Rating	Comments		
Domain 6: Confounding	·					
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
	M (1 00	Design and Procedures		conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	N/A	Statistical analysis is not typically applied to accumulation.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:	Asbestos bo	dies were found in the spleen and lungs.				
Overall Qualit	ty Detern	nination	Medium			

Study Citation:	Hilding, A. C., Hilding, D. A., Larson, D. M., Aufderheide, A. C. (1981). Biological effects of ingested amosite asbestos, taconite tailings, diatomaceous earth and Lake Superior water in rats. Archives of Environmental Health 36(6):298-303.							
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary							
Exposure Route,								
Media, Path:								
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Sprague-Da	wly; Juvenile					
Health Outcome:	Cancer/Carc	vinogenesis						
Chemical:	asbestos (CA	ASRN 1332-21-4)-chrysotile (serpentine) (C	CASRN 12001-2	9-5)-amosite (grunerite) (CASRN 12172-73-5)				
HERO ID:	3098168							
Domain		Metric	Rating	Comments				
Domain 1: Test Substand								
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.				
	Metric 2:	Test Substance Source	High	The amosite asbestos was UICC Standard Reference Amosite Asbestos from the R.E.G Rendall Pneumoconiosis Research Unit in Johannesburg, South Africa. The chrysotile was from Johns Manville Co. in Denver, CO.				
	Metric 3:	Test Substance Purity	Low	The purity/contents of the asbestos was not reported.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	The study reported using 28 rats that were given fiber free well water for the first 9 months and then filtered Duluth municipal water thereafter.				
	Metric 5:	Negative Control Response	High	The control response can be seen in Table 1 and it is adequate.				
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were allocated into study groups.				
Domain 3: Exposure Ch	aracterization							
I	Metric 7:	Experimental System/Test Media	High	The test system was described adequately. There were five rats per cage and the numbe				
		Preparation	C C	of rats per treatment were reported. Preparation for each exposure was also described adequately.				
	Metric 8:	Consistency of Exposure Administration	Medium	The low dose asbestos treatment reported using chrysotile for the first 7 months due to the unavailability of the amosite fibers. At month 8, the rats were switched to a diet containing amosite fibers as they became available.				
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether they analyzed the asbestos fibers prior to test- ing or during testing.				
	Metric 10:	Exposure Duration and Frequency	High	The study duration was for the lifetime of the rats and was appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent effect. The goal was to observe the pathological response of rats to exposure from asbestos, like fibers from different sources.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble substance and the exposure was via diet.				
Domain 4: Test Organisı	m							
	Metric 13:	Test Organism Characteristics	Low	The rats were described as weanling Sprague-Dawly rats. The source of the rats was no reported.				
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the rats were acclimated to test conditions.				
			nued on next pa	30A				

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Study Citation:	Hilding, A. C., Hilding, D. A., Larson, D. M., Aufderheide, A. C. (1981). Biological effects of ingested amosite asbestos, taconite tailings, diatomaceous					
Duration:	earth and Lake Superior water in rats. Archives of Environmental Health 36(6):298-303. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:						
Faxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Sprague-Dawly; Juvenile					
Health Outcome:	Cancer/Carcinogenesis					
Chemical: HERO ID:	asbestos (CA 3098168	ASRN 1332-21-4)-chrysotile (serpentine) (Ca	ASRN 12001-29	9-5)-amosite (grunerite) (CASRN 12172-73-5)		
Domain		Metric	Rating	Comments		
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The number of test organisms for each treatment was reported in the "Materials and Methods" section.		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Medium	The diet of the rats for each treatment was reported, but other environmental conditions were not reported by the study authors.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was tumor formation in different tissues of the rat.		
	Metric 18:	Consistency of Outcome Assessment	Low	Little detail on the outcome assessment was described other than to say detailed autop- sies were performed.		
Domain 6: Confounding	y / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported if the rats were acclimatized to the test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Details regarding test organism attrition and outcomes unrelated to exposure were reported. It was reported that 3 rats were cannibalized before they could be examined.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Analysis of the test groups compared to the controls was done by 2 x k contingency ta- ble described by Armitage and was performed by the University of Minnesota Divisior of Biometry, School of Public Health.		
	Metric 22:	Reporting of Data	High	Data for each exposure was adequate and reported in Table 1.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.		
Additional Comments:	This was a dietary exposure to various sources of asbestos fibers. Exposure was either through drinking water or through food. The researchers examine the rats for tumors after the lifetime exposure.					

Overall Quality Determination

Medium

Asbestos

Study Citation:	Hilding, A. C., Hilding, D. A., Larson, D. M., Aufderheide, A. C. (1981). Biological effects of ingested amosite asbestos, taconite tailings, diatomaceous earth and Lake Superior water in rats. Archives of Environmental Health 36(6):298-303.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route ,	Terrestrial; Food/Diet; Dietary
Media, Path:	
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Sprague-Dawly; Juvenile
Health Outcome:	Mortality
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3098168

Domain		Metric	Rating	Comments
Domain 1: Test Substan				
	Metric 1:	Test Substance Identity	Low	The test substance was identified by name only.
	Metric 2:	Test Substance Source	High	The amosite asbestos was UICC Standard Reference Amosite Asbestos from the R.E.G. Rendall Pneumoconiosis Research Unit in Johannesburg, South Africa. The chrysotile was from Johns Manville Co. in Denver, CO.
	Metric 3:	Test Substance Purity	Low	The purity/contents of the asbestos was not reported.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	The study reported using 28 rats that were given fiber free well water for the first 9 months and then filtered Duluth municipal water thereafter.
	Metric 5:	Negative Control Response	High	The control response can be seen in Table 1 and it is adequate.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were allocated into study groups.
Domain 3: Exposure Ch	aracterization			
·	Metric 7:	Experimental System/Test Media Preparation	High	The test system was described adequately. There were five rats per cage and the number of rats per treatment were reported. Preparation for each exposure was also described adequately.
	Metric 8:	Consistency of Exposure Administration	Medium	The low dose asbestos treatment reported using chrysotile for the first 7 months due to the unavailability of the amosite fibers. At month 8, the rats were switched to a diet containing amosite fibers as they became available.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether they analyzed the asbestos fibers prior to test- ing or during testing.
	Metric 10:	Exposure Duration and Frequency	High	The study duration was for the lifetime of the rats and was appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal of the study was not to have a dose dependent effect. The goal was to observe the pathological response of rats to exposure from asbestos, like fibers from different sources.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is an insoluble substance and the exposure was via diet.
Domain 4: Test Organis	m			
	Metric 13:	Test Organism Characteristics	Low	The rats were described as weanling Sprague-Dawly rats. The source of the rats was no reported.
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the rats were acclimated to test conditions.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The number of test organisms for each treatment was reported in the "Materials and Methods" section.
		Conti	inued on next pa	

			ued from previ			
Study Citation:	Hilding, A. C., Hilding, D. A., Larson, D. M., Aufderheide, A. C. (1981). Biological effects of ingested amosite asbestos, taconite tailings, diatomaceous earth and Lake Superior water in rats. Archives of Environmental Health 36(6):298-303. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary					
Duration:						
Exposure Route,						
Media, Path:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; Sprague-Dawly; Juvenile					
Taxa, Species, Age:						
Health Outcome:	Mortality					
Chemical:	2	ASRN 1332-21-4)-chrysotile (serpentine) (C.	ASRN 12001-29	0-5)-amosite (grunerite) (CASRN 12172-73-5)		
HERO ID:	3098168					
Domain		Metric	Rating	Comments		
Domain 5: Outcome As	sessment					
	Metric 16:	Adequacy of Test Conditions	Medium	The diet of the rats for each treatment was reported, but other environmental conditions were not reported by the study authors.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was tumor formation in different tissues of the rat.		
	Metric 18:	Consistency of Outcome Assessment	Low	Little detail on the outcome assessment was described other than to say detailed autop- sies were performed.		
Domain 6: Confounding	, / Variable Co	atrol				
Domain 0. Confounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental		
		Design and Procedures		conditions. It was not reported if the rats were acclimatized to the test conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Details regarding test organism attrition and outcomes unrelated to exposure were reported. It was reported that 3 rats were cannibalized before they could be examined.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	High	Analysis of the test groups compared to the controls was done by 2 x k contingency ta- ble described by Armitage and was performed by the University of Minnesota Division of Biometry, School of Public Health.		
	Metric 22:	Reporting of Data	High	Data for each exposure was adequate and reported in Table 1.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability.		
Additional Comments:		ietary exposure to various sources of asbesto umors after the lifetime exposure.	os fibers. Expos	ure was either through drinking water or through food. The researchers examine		

Overall Quality Determination

Medium

Study Citation:							
Duration:	 short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary 						
Exposure Route,	Terrestrial; I	Food/Diet; Dietary					
Media, Path:	Vantahnatas	Mammalian, Pattus nomenious, MPC Has	dad. Nat Ann	liashla (a.a. funci an alaga studios) an Nat Deported			
Taxa, Species, Age:			ded; Not App	licable (e.g., fungi or algae studies) or Not Reported			
Health Outcome: Chemical:	Gastrointest						
HERO ID:	chrysotile (serpentine) (CASRN 12001-29-5) 112						
Domain	112	Metric	Rating	Comments			
Domain 1: Test Substar	229	Metric	Katilig	Comments			
Domain 1. Test Substan	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.			
	Metric 1: Metric 2:	Test Substance Source	Low				
	Metric 2: Metric 3:	Test Substance Purity	Low	The test substance identity was not analytically verified by the performing laboratory.			
	Metric 5:	Test Substance Furity	LOW	Purity and/or grade of test substance were not reported.			
Domain 2: Test Design							
0	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.			
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.			
	, . ,.						
Domain 3: Exposure Cl	Metric 7:	Experimental System/Test Media	Low	The study provided only limited details on the measures taken to appropriately prepare			
	Metric 7.	Preparation	LOW	test concentrations.			
	Metric 8:	Consistency of Exposure	Medium	Details of the exposure administration were not elaborated on.			
	Metric 0.	Administration	Wiedium	Details of the exposure administration were not elaborated on.			
	Metric 9:	Measurement of Test Substance	Low	Exposure concentrations were not measured.			
		Concentration					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was adequate for a dietary rat exposure.			
	Metric 11:	Number of Exposure Groups/	Medium	Only two exposure levels were tested.			
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Evennes was via dist			
	Methic 12.	Testing at of Below Solubility Linit	IN/A	Exposure was via diet.			
Domain 4: Test Organis	sm						
0	Metric 13:	Test Organism Characteristics	Low	Few details were reported, such as initial weight.			
	Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.			
	Metric 15:	Conditions Number of Organisms and	Low	The number of test organisms and/or replicates was not reported.			
		Replicates per Group					
Domain 5: Outcome As		Adaguage of Test Car ditions	T				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.			
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology addressed the intended outcomes of interest, although sample size was not reported.			
		Cont	inued on nex	t page			

continued from previous page					
Study Citation:	Jacobs, R., Humphrys, J., Dodgson, K. S., Richards, R. J. (1978). Light and electron microscope studies of the rat digestive tract following prolonged and short-term ingestion of chrysotile asbestos. International Journal of Experimental Pathology 59(5):443-453. Overall Duration: > 21 days; Exposure Duration: > 21 days				
Duration:					
Exposure Route,	Terrestrial; Food/Diet; Dietary				
Media, Path:		-			
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; MRC Hood	led; Not App	licable (e.g., fungi or algae studies) or Not Reported	
Health Outcome:	Gastrointesti	inal			
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)			
HERO ID:	112				
Domain		Metric	Rating	Comments	
	Metric 18:	Consistency of Outcome Assessment	Medium	There were minor uncertainties in the outcome assessment study group size.	
Domain 6: Confounding	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental	
		Design and Procedures		conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups.	
Domain 7: Data Present	ation and Anal	ysis			
	Metric 21:	Statistical Methods	N/A	The study focused on pathology findings.	
	Metric 22:	Reporting of Data	Low	Data were only reported for some outcomes.	
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained.	
Additional Comments:	None				
Overall Qualit	ty Detern	nination	Low		

Study Citation:	Environmen	tal Health Perspectives 53:27-44.		ffects of dietary exposure to amosite asbestos and tremolite in F344 rats.
Duration:		ation: > 21 days; Exposure Duration: > 21 da	lys	
Exposure Route,	Terrestrial; F	Food/Diet, N/A (e.g., injection); Dietary		
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fischer 344; A	Adult	
Health Outcome:	Reproductive	e/Teratogenic		
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)-amosite (gru	inerite) (CASRN 1217	2-73-5)-tremolite (CASRN 14567-73-8)
HERO ID:	709664			
Domain		Metric	Rating	Comments
Domain 1: Test Substar	nce			
	Metric 1:	Test Substance Identity	Medium	No CAS number was given, but mineral and fiber characteristics were reported in Table 1-5.
	Metric 2:	Test Substance Source	High	The source was reported.
	Metric 3:	Test Substance Purity	High	The chemicals were analytically verified by the performing laboratory and mineral and fiber characteristics were reported.
Domain 2: Test Design				
U	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported in the text as an average.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Cl	paracterization			
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in
	Methe 7.	Preparation	mgn	adequate detail.
	Metric 8:	Consistency of Exposure	High	There was not any mention of irregularities in exposure administration.
	Medie 0.	Administration	mgn	There was not any mention of megatarities in exposure administration.
	Metric 9:	Measurement of Test Substance	Medium	Each lot of the blended pellet feed was analyzed for amosite and tremolite (results not
		Concentration		reported), but no measurement was done on the PWG treatments, though this was likely
				not to have significant impacts on results.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration per fiber type (1% in diet) and a dose depen
		Spacing of Exposure Levels		dent effect was not the goal of the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure is asbestos via diet and/or gavage.
Domain 4: Test Organis	sm			
0	Metric 13:	Test Organism Characteristics	High	Test organisms were adequately described.
	Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized. It is unclear whether
		Conditions		the gavage group had a counterpart control (gavage with sterile water only).
	Metric 15:	Number of Organisms and	Low	The number of test organisms and/or replicates was not reported.
		Replicates per Group		

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		co	ntinued from previous	page				
Study Citation:	Mcconnell, E. E., Rutter, H. A., Ulland, B. M., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats.							
	Environmen	Environmental Health Perspectives 53:27-44.						
Duration:	Overall Dura	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary							
Media, Path:								
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Fischer 344; Adult							
Health Outcome:	Reproductive/Teratogenic							
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)-amosite (grunerite) (CASRN 12172-73-5)-tremolite (CASRN 14567-73-8)							
HERO ID:	709664							
Domain		Metric	Rating	Comments				
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conduciv to maintenance of health, and biomass loading was appropriate.				
	Metric 17:	Outcome Assessment Methodology	High	Live fetuses were counted at birth.				
	Metric 18:	Consistency of Outcome	High	Litter size was assessed at birth.				
		Assessment						
Domain 6: Confounding	g / Variable Co	ntrol						
·	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental condition				
		Design and Procedures	0	or other factors that could influence the outcome assessment.				
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure (e.g., infection) that could influence the outcome assessment.				
Domain 7: Data Presen	tation and Anal	vsis						
	Metric 21:	Statistical Methods	Uninformative	No statistics were conducted for significant difference on litter size.				
	Metric 22:	Reporting of Data	Low	Data was reported as average litter size without variance.				
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals and/or insufficient information was provided to determine if excessive variability or unexpected outcomes occurred.				
Additional Comments:	diet post we	eaning. PWG with chrysotile (used mistaker	nly instead of amosite)	The study was done on the offspring which were put on the appropriate was also used in one study group that went on to receive the amosite nd thus the growth/development outcome was selected.				

Overall Quality Determination

Uninformative

Study Citation:			, J. A. (1983). C	hronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats.					
Duration: Exposure Route,	Overall Dur	tal Health Perspectives 53:27-44. ation: > 21 days; Exposure Duration: > 21 Food/Diet, N/A (e.g., injection); Dietary	days						
Media, Path:	T T (1 (1								
Taxa, Species, Age:		Mammalian; <i>Rattus norvegicus</i> ; Fischer 344	; Embryo						
Health Outcome:	Cancer/Carc			NI 10170 72 5) terme lite (CASDNI 145(7 72 9)					
Chemical: HERO ID:	709664	chrysotile (serpentine) (CASRN 12001-29-5)-amosite (grunerite) (CASRN 12172-73-5)-tremolite (CASRN 14567-73-8) 709664							
Domain	10,001	Metric	Rating	Comments					
Domain 1: Test Substan	ce		Tutting						
	Metric 1:	Test Substance Identity	Medium	No CAS number was given, but mineral and fiber characteristics were reported in Tables 1-5.					
	Metric 2:	Test Substance Source	High	Sources were reported.					
	Metric 3:	Test Substance Purity	High	The chemicals were analytically verified by the performing laboratory and mineral and fiber characteristics were reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Tables 8-17 and it appears adequate.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Domain 3: Exposure Ch	aracterization								
Domain 5. Exposure er	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in					
		Preparation		adequate detail.					
	Metric 8:	Consistency of Exposure	High	There was not any mention of irregularities in exposure administration.					
		Administration							
	Metric 9:	Measurement of Test Substance	Medium	Each lot of the blended pellet feed was analyzed for amosite and tremolite (results not shown), but no measurement was done on the PWG treatments, though this was likely					
		Concentration		not to have significant impacts on results.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type (chronic).					
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration per fiber type $(1\%$ in diet) and a dose depen					
		Spacing of Exposure Levels		dent effect was not the goal of the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure via diet and/or gavage.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	High	Test organisms were adequately described.					
	Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized. It is unclear whether					
	M. 4	Conditions	Madin	the gavage group had a counterpart control (gavage with sterile water only).					
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The number of test organisms was sufficient to characterize toxicological effects and it is reported in the tables in Results.					
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to maintenance of health, and biomass loading was appropriate.					
		Conti	nued on next pa	~ ^					

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Study Citation:		E. E., Rutter, H. A., Ulland, B. M., Moore, J tal Health Perspectives 53:27-44.	J. A. (1983). C	hronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats.		
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary					
Media, Path:	,	······································				
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Fischer 344; Embryo					
Health Outcome:	Cancer/Carc	-	2			
Chemical:		6	unerite) (CAS	RN 12172-73-5)-tremolite (CASRN 14567-73-8)		
HERO ID:	709664					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology (pathology) reported the intended outcome of interest.		
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups.		
Domain 6: Confounding	g / Variable Con Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Male amosite treated rats had a higher rate of C-Cell carcinoma, and male amosite and amosite + PWG had a higher rate of mononuclear cell leukemia. These were not though to be treatment related.		
Domain 7: Data Present	ation and Anal	lysis				
	Metric 21:	Statistical Methods	High	Statistical methods were well-described.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Tables 8-17 and discussed in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.		
Additional Comments:		aning. PWG with chrysotile was also inadve		lite diet. The study was done on the offspring which were put on the appropriate nstead of gavage with 1% amosite) in one study group that went on to receive the		
Overall Qualit	ty Detern	nination	Medium	l		

Study Citation:	Environmen	tal Health Perspectives 53:27-44.		ffects of dietary exposure to amosite asbestos and tremolite in F344 rats.					
Duration: Exposure Route,		ation: > 21 days; Exposure Duration: > 21 da Food/Diet, N/A (e.g., injection); Dietary	lys						
Media, Path:	V								
Faxa, Species, Age: Health Outcome:	Behavioral	Mammalian; Rattus norvegicus; Fischer 344; E	embryo						
Chemical:		erpentine) (CASRN 12001-29-5)-amosite (gru	merite) (CASRN 1217	2-73-5)-tremolite (CASRN 14567-73-8)					
HERO ID:	709664								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan	ce Metric 1:	Test Substance Identity	Medium	No CAS number was given, but mineral and fiber characteristics were reported in Table 1-5.					
	Metric 2:	Test Substance Source	High	The source was reported.					
	Metric 3:	Test Substance Purity	High	The chemicals were analytically verified by the performing laboratory and mineral and fiber characteristics were reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Low	The biological response of the negative control groups was not reported.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Domain 3: Exposure Ch	aracterization								
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	There was not any mention of irregularities in exposure administration.					
	Metric 9:	Administration Measurement of Test Substance Concentration	Medium	Each lot of the blended pellet feed was analyzed for amosite and tremolite (results not reported), but no measurement was done on the PWG treatments, though this was likely not to have significant impacts on results.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration per fiber type (1% in diet) and a dose dependent effect was not the goal of the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure is asbestos via diet and/or gavage.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	High	Test organisms were adequately described.					
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized. It is unclear whether the gavage group had a counterpart control (gavage with sterile water only).					
	Metric 15:	Number of Organisms and Replicates per Group	Low	The number of test organisms and/or replicates was not reported.					
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to maintenance of health, and biomass loading was appropriate.					
	Metric 17:	Outcome Assessment Methodology	Medium	There were minimal details regarding determination of food consumption.					
		Co	ntinued on next page						

			ntinued from previous	page		
Study Citation:	Mcconnell, E. E., Rutter, H. A., Ulland, B. M., Moore, J. A. (1983). Chronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats. Environmental Health Perspectives 53:27-44.					
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ays			
Exposure Route,		Food/Diet, N/A (e.g., injection); Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fischer 344; I	Embryo			
Health Outcome:	Behavioral					
Chemical: HERO ID:	chrysotile (so 709664	erpentine) (CASRN 12001-29-5)-amosite (gr	unerite) (CASRN 12172	2-73-5)-tremolite (CASRN 14567-73-8)		
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome Assessment	High	Food consumption was measured weekly per cage.		
Domain 6: Confounding	g / Variable Cor	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental condition or other factors that could influence the outcome assessment.		
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure (e.g., infection) that could influence the outcome assessment.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	Uninformative	It does not appear that statistical analysis was performed on food consumption of treate groups relative to the control.		
	Metric 22:	Reporting of Data	Low	Data was reported as percentages compared to control groups in the text, but no table or figure was presented. No food amounts were presented.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	The study did not report any measures of variability (e.g., SE, SD, confidence intervals and/or insufficient information was provided to determine if excessive variability or unexpected outcomes occurred.		

diet.Differences in weight between treatment groups and controls were reported and thus the growth/development outcome was selected.

Study Citation:			J. A. (1983). C	hronic effects of dietary exposure to amosite asbestos and tremolite in F344 rats.					
D		tal Health Perspectives 53:27-44.	1						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrich Food (Dict N(A (a.g., injection)) Dictory								
Exposure Route, Media, Path:	Terresultar, I	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary							
Taxa, Species, Age:	Vertebrate: I	Mammalian; Rattus norvegicus; Fischer 344	·Embryo						
Health Outcome:	Mortality		, 2						
Chemical:	-	erpentine) (CASRN 12001-29-5)-amosite (§	grunerite) (CASI	RN 12172-73-5)-tremolite (CASRN 14567-73-8)					
HERO ID:	709664	-							
Domain		Metric	Rating	Comments					
Domain 1: Test Substand		— — — — — — — — — —							
	Metric 1:	Test Substance Identity	Medium	No CAS number was given, but mineral and fiber characteristics were reported in Table 1-5.					
	Metric 2:	Test Substance Source	High	Sources were reported.					
	Metric 3:	Test Substance Purity	High	The chemicals were analytically verified by the performing laboratory and mineral and fiber characteristics were reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Table 7, and it appears adequate.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Demois 2. Erreener Ch									
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in					
	Methe 7.	Preparation	Ingn	adequate detail.					
	Metric 8:	Consistency of Exposure	High	There was not any mention of irregularities in exposure administration.					
		Administration							
	Metric 9:	Measurement of Test Substance	Medium	Each lot of the blended pellet feed was analyzed for amosite and tremolite (results not					
		Concentration		shown), but no measurement was done on the PWG treatments, though this was likely not to have significant impacts on results.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type (chronic).					
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration per fiber type (1% in diet) and a dose deper					
		Spacing of Exposure Levels		dent effect was not the goal of the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.					
Domain 4: Test Organisı	m								
	Metric 13:	Test Organism Characteristics	High	Test organisms were adequately described.					
	Metric 14:	Acclimatization and Pretreatment	Medium	The study did not report whether test organisms were acclimatized. It is unclear whether					
		Conditions		the gavage group had a counterpart control (gavage with sterile water only).					
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The number of test organisms was sufficient to characterize toxicological effects and it reported in Table 7 in Results.					
Domain 5: Outcome Ass	resement								
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive					
		racquacy of rest conditions	ingn	to maintenance of health, and biomass loading was appropriate.					
		Conti	nued on next pa						

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		····continu	ieu nom previ	ous page		
Study Citation:		E. E., Rutter, H. A., Ulland, B. M., Moore, J tal Health Perspectives 53:27-44.	. A. (1983). C	hronic effects of dietary exposure to amosite asbestos and tremolite in F344 rate		
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary					
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; Fischer 344; I	Embryo			
Health Outcome:	Mortality					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)-amosite (grunerite) (CASRN 12172-73-5)-tremolite (CASRN 14567-73-8)					
HERO ID:	709664					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	High	Mortality was assessed.		
	Metric 18:	Consistency of Outcome Assessment	High	Mortality was assessed twice daily.		
Domain 6: Confounding	g / Variable Cor	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental condition or other factors that could influence the outcome assessment.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Details regarding test organism attrition and outcomes unrelated to exposure (e.g., in- fection) were reported for each study group and there were no differences among group that could influence the outcome assessment.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical methods for survival were described in Methods.		
	Metric 22:	Reporting of Data	High	Data for survival is shown in Table 7.		
	Metric 23:	Explanation of Unexpected Outcomes	High	The study did not report any measures of variability (e.g., SE, SD, confidence intervals and/or insufficient information was provided to determine if excessive variability or unexpected outcomes occurred.		
Additional Comments:		aning. PWG with chrysotile was also inadve		lite diet. The study was done on the offspring which were put on the appropriat istead of gavage with 1% amosite) in one study group that went on to receive the		
Overall Qualit	ty Detern	nination	Medium			

Study Citation:		E. E., Rutter, H. A., Ulland, B. M., Moore, J. tal Health Perspectives 53:27-44.	A. (1983). Chronic e	ffects of dietary exposure to amosite asbestos and tremolite in F344 rats.					
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ys						
Exposure Route,		Food/Diet, N/A (e.g., injection); Dietary							
Media, Path:									
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; Fischer 344; Embryo							
Health Outcome:	Developmen		2						
Chemical:	•	erpentine) (CASRN 12001-29-5)-amosite (gru	merite) (CASRN 1217	2-73-5)-tremolite (CASRN 14567-73-8)					
HERO ID:	709664		<i>,</i> , ,						
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1:	Test Substance Identity	Medium	No CAS number was given, but mineral and fiber characteristics were reported in Table 1-5.					
	Metric 2:	Test Substance Source	High	The source was reported.					
	Metric 3:	Test Substance Purity	High	The chemicals were analytically verified by the performing laboratory and mineral and fiber characteristics were reported.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	Low	The biological response of the negative control groups was not reported.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Domain 3: Exposure Ch	aracterization								
-	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	There was not any mention of irregularities in exposure administration.					
		Administration							
	Metric 9:	Measurement of Test Substance	Medium	Each lot of the blended pellet feed was analyzed for amosite and tremolite (results not reported), but no measurement was done on the PWG treatments, though this was likely					
		Concentration		not to have significant impacts on results.					
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/	N/A	There was only one exposure concentration per fiber type (1% in diet) and a dose depen					
		Spacing of Exposure Levels		dent effect was not the goal of the study.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure is asbestos via diet and/or gavage.					
Domain 4: Test Organis	m								
-	Metric 13:	Test Organism Characteristics	High	Test organisms were adequately described.					
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized. It is unclear whethe gavage group had a counterpart control (gavage with sterile water only).					
	Metric 15:	Number of Organisms and	Low	The number of test organisms and/or replicates was not reported.					
		Replicates per Group	20.0						
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Organism housing, environmental conditions, food, water, and nutrients were conducive to maintenance of health, and biomass loading was appropriate.					
	Metric 17:	Outcome Assessment Methodology	Medium	Minimal details were given about the weighing procedure.					
		0	ntinued on next page						

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		co	ntinued from previous	page			
Study Citation:		E. E., Rutter, H. A., Ulland, B. M., Moore, J tal Health Perspectives 53:27-44.	. A. (1983). Chronic eff	fects of dietary exposure to amosite asbestos and tremolite in F344 rats.			
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 days	ays				
Exposure Route,	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; Fischer 344; Embryo						
Health Outcome:	Developmen	t/Growth					
Chemical: HERO ID:	chrysotile (s 709664	erpentine) (CASRN 12001-29-5)-amosite (gr	unerite) (CASRN 12172	-73-5)-tremolite (CASRN 14567-73-8)			
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome Assessment	High	"Mean body weights analyzed selected were at intervals: birth, 3, 8, 11, 15, 24, 33, and 60 weeks for the males, and birth, 3, 8, 11, 16, 27, 48 and 60 weeks for the females by the method of Rao (9)."			
Domain 6: Confounding	0						
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental condition or other factors that could influence the outcome assessment.			
	Metric 20:	Outcomes Unrelated to Exposure	Medium	There was no information in the study to suggest differences among groups in animal attrition or health outcomes unrelated to exposure (e.g., infection) that could influence the outcome assessment.			
Domain 7: Data Present	tation and Anal	vsis					
	Metric 21:	Statistical Methods	Uninformative	No statistics were conducted for significant difference on body weights.			
	Metric 22:	Reporting of Data	Low	Data was reported as percentages compared to control groups in the text, but no table of figure were presented. No body weights were presented.			

diet.Differences in weight between treatment groups and controls were reported and thus the growth/development outcome was selected.

Overall Quality Determination

Uninformative

Study Citation:			of crocidolite	e asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicolog				
		chnical Report Series 280:1-178.						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported Mortality							
Exposure Route,								
Media, Path:								
Taxa, Species, Age:								
Health Outcome:								
Chemical:		riebeckite) (CASRN 12001-28-4)						
HERO ID:	3613439							
Domain		Metric	Rating	Comments				
Domain 1: Test Substand	ce							
	Metric 1:	Test Substance Identity	Medium	The test substance was identified and the specific form was characterized.				
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer, or the production pro- cess was specifically identified.				
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.				
Domain 2: Test Design								
2 oniani 21 1000 2 001gn	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for reported outcomes.				
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.				
Domain 3: Exposure Ch	aracterization							
	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in				
		Preparation		adequate detail.				
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
		Administration						
	Metric 9:	Measurement of Test Substance	Medium	Each lot was analyzed.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.				
	Metric 10. Metric 11:	Number of Exposure Groups/	High N/A					
	Metric 11:		N/A	Only one concentration was tested.				
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.				
	Wiettie 12.	Testing at of Delow Solubility Ellint	10/11	Exposure was via dict.				
Domain 4: Test Organisi	n							
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.				
		Conditions	-	_ 1 V				
	Metric 15:	Number of Organisms and	Medium	An adequate number of animals were used. Individuals were used as replicates.				
		Replicates per Group						
Domain 5: Outcome Ass	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.				
		Cont	inued on nex	t nage				
		Cont	inucu on nex					

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Study Citation:			of crocidolite	e asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicolog				
		chnical Report Series 280:1-178.						
Duration:		ation: > 21 days; Exposure Duration: > 21	l days					
Exposure Route,	Terrestrial; F	Food/Diet; Dietary						
Media, Path:								
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:	Mortality	Mortality						
Chemical:	crocidolite (1	riebeckite) (CASRN 12001-28-4)						
HERO ID:	3613439							
Domain		Metric	Rating	Comments				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain (, Confounding	Variable Ca	ntrol						
Domain 6: Confounding			Ŧ					
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental conditions.				
	M-4-1- 20.	Design and Procedures	II: -1-					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups that could influence the outcome assessment.				
Domain 7: Data Present	ation and Anal	lvsis						
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.				
Additional Comments:	Nona							
Auunonai Comments:	None							
Overall Qualit	ty Deterr	nination	High					

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Study Citation: Duration: Exposure Route,	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology Program Technical Report Series 280:1-178. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary								
Media, Path: Taxa, Species, Age: Health Outcome:		Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported Development/Growth							
Chemical: HERO ID:	crocidolite (1 3613439	riebeckite) (CASRN 12001-28-4)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substan									
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Medium High	The test substance was identified and the specific form was characterized. The source of the test substance was reported as a manufacturer, or the production pro- cess was specifically identified.					
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.					
Domain 2: Test Design									
2 onian 21 Test 2 toigh	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for reported outcomes.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Domain 3: Exposure Ch	aracterization								
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in					
		Preparation	8	adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance	Medium	Each lot was analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.					
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.					
Domain 4: Test Organis	m								
in root organity	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.					
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	An adequate number of animals were used. Individuals were used as replicates.					
Domain 5: Outcome As	sessment								
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
		Cont	tinued on nex	at page					

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Study Citation:	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology						
Study Citation.		chnical Report Series 280:1-178.		23003103 (Cas no. 12001-20-7) in 15+7/n rats (recu statics). National toxicolog,			
Duration:		ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,		Food/Diet; Dietary					
Media, Path:	,	, , , , , , , , , , , , , , , , , , ,					
Taxa, Species, Age:	Vertebrate; N	Mammalian; <i>Rattus norvegicus</i> ; F344/N; No	ot Applicabl	e (e.g., fungi or algae studies) or Not Reported			
Health Outcome:	Developmen	tt/Growth					
Chemical:	-	crocidolite (riebeckite) (CASRN 12001-28-4)					
HERO ID:	3613439						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	y / Variable Co	ntrol					
Domain 0. Comoundany	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
	infetite 19.	Design and Procedures	Low	conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups that could influence the outcome assessment.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Quali	ty Dotorr	nination	High				

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Study Citation:	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology Program Technical Report Series 280:1-178. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Duration: Exposure Route, Media, Path:		ation: > 21 days; Exposure Duration: > 2 Food/Diet; Dietary	l days			
Taxa, Species, Age: Health Outcome:	Cancer/Carc	inogenesis	lot Applicable	e (e.g., fungi or algae studies) or Not Reported		
Chemical: HERO ID:	crocidolite (3613439	riebeckite) (CASRN 12001-28-4)				
Domain		Metric	Rating	Comments		
Domain 1: Test Substan						
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Medium High	The test substance was identified and the specific form was characterized. The source of the test substance was reported as a manufacturer, or the production pro- cess was specifically identified.		
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.		
Domain 2: Test Design						
Domain 2. Test Design	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for reported outcomes.		
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.		
Domain 3: Exposure Ch	aracterization					
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.		
	Metric 9:	Administration Measurement of Test Substance	Medium	Each lot was analyzed.		
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.		
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.		
	Metric 12:	Spacing of Exposure Levels Testing at or Below Solubility Limit	N/A	Exposure was via diet.		
Domain 4: Test Organis	m					
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	An adequate number of animals were used. Individuals were used as replicates.		
Domain 5: Outcome Ass	sessment	· · ·				
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.		
		Cont	tinued on nex	ct page		

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Study Citation:	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology						
Study Citation.		chnical Report Series 280:1-178.		e assestos (Cas no. 12001-26-4) in 1544/ii fats (reed studies). National foxicolog			
Duration:		ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported					
Health Outcome:	Cancer/Carc	Cancer/Carcinogenesis					
Chemical:		crocidolite (riebeckite) (CASRN 12001-28-4)					
HERO ID:	3613439						
Domain		Metric	Rating	Comments			
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
		Assessment					
Domain 6: Confounding	y / Variable Co	ntrol					
Domain o. Comounding	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental			
		Design and Procedures	2011	conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups that could influence the outcome assessment.			
Domain 7: Data Present		5					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Quali	ty Dotorr	ningtion	High				

Study Citation: Duration: Exposure Route, Media, Path:	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology Program Technical Report Series 280:1-178. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary								
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported							
Health Outcome:	Behavioral		II	((6) - 6 - 6 - 6 - 6 - 1 - 1 - 1 - 1					
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)							
HERO ID:	3613439								
Domain		Metric	Rating	Comments					
Domain 1: Test Substan			14 P						
	Metric 1:	Test Substance Identity	Medium	The test substance was identified and the specific form was characterized.					
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer, or the production pro- cess was specifically identified.					
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.					
	Mette 5.		mgn						
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for reported outcomes.					
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.					
Domain 3: Exposure Ch									
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.					
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.					
	Metric 9:	Administration Measurement of Test Substance	Medium	Each lot was analyzed.					
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.					
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.					
		Spacing of Exposure Levels	1.011						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.					
Domain 4: Test Organis	m								
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.					
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.					
		Conditions	C	· · · · · · · · · · · · · · · · · · ·					
	Metric 15:	Number of Organisms and	Medium	An adequate number of animals were used. Individuals were used as replicates.					
		Replicates per Group							
Domain 5: Outcome As	sessment								
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.					
			tinued on nex						

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				n evious page				
Study Citation:		 Toxicology and carcinogenesis studies o chnical Report Series 280:1-178. 	f crocidolite	e asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology				
Duration:		ation: > 21 days; Exposure Duration: > 21	davs					
Exposure Route,		Food/Diet; Dietary						
Media, Path:	,-							
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:	Behavioral	Behavioral						
Chemical:	crocidolite (1	crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	3613439							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	y / Variable Co	ntrol						
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
		Design and Procedures		conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups that could influence the outcome assessment.				
Domain 7: Data Present	ation and Anal	lysis						
Domain // Duta 11050m	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.				
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.				
Additional Comments:	None							
Overall Qualit	ty Deterr	nination	High					

Study Citation:	NTP, (1988). Toxicology and carcinogenesis studies of crocidolite asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicology							
		Program Technical Report Series 280:1-178.						
Duration:		ation: > 21 days; Exposure Duration: > 2	1 days					
Exposure Route,	Terrestrial; I	Food/Diet; Dietary						
Media, Path:								
Taxa, Species, Age:		, , , , , , , , , , , , , , , , , , , ,	lot Applicable	e (e.g., fungi or algae studies) or Not Reported				
Health Outcome:	1	e/Teratogenic						
Chemical:		riebeckite) (CASRN 12001-28-4)						
HERO ID:	3613439							
Domain		Metric	Rating	Comments				
Domain 1: Test Substar	nce							
	Metric 1:	Test Substance Identity	Medium	The test substance was identified and the specific form was characterized.				
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer, or the production pro- cess was specifically identified.				
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.				
Domain 2: Test Design		Na satissa Casatas la	TT: -1-					
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for reported outcomes.				
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.				
Domain 3: Exposure C	haracterization							
Domain 5. Exposure C	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in				
	metric /.	Preparation	mgn	adequate detail.				
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.				
		Administration	-					
	Metric 9:	Measurement of Test Substance	Medium	Each lot was analyzed.				
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure was reported and suitable for the study type.				
	Metric 11:	Number of Exposure Groups/	N/A	Only one concentration was tested.				
		Spacing of Exposure Levels		-				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.				
Domain 4: Tast Orcani								
Domain 4: Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adapted by described and were obtained from a reliable source				
	Metric 13: Metric 14:	Acclimatization and Pretreatment	High High	The test organisms were adequately described and were obtained from a reliable source. All pretreatment conditions were the same for control and exposed organisms.				
	wieure 14.	Conditions	Ingil	An pretreatment conditions were the same for control and exposed organisms.				
	Metric 15:	Number of Organisms and Replicates per Group	Medium	An adequate number of animals were used. Individuals were used as replicates.				
Domain 5: Outcome As								
	M . 1 1 C		TT' 1					

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Standar Citations	NTD (1000)	T	£	= -12001.28 (Constant) Network (Early static) Network Terrical				
Study Citation:		chnical Report Series 280:1-178.	or crocidoinu	e asbestos (Cas no. 12001-28-4) in F344/n rats (Feed studies). National Toxicolog				
Duration:		ation: > 21 days; Exposure Duration: > 21	davs					
Exposure Route,		Food/Diet; Dietary	uujo					
Media, Path:	,-							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported							
Health Outcome:		e/Teratogenic						
Chemical:	crocidolite (1	crocidolite (riebeckite) (CASRN 12001-28-4)						
HERO ID:	3613439							
Domain		Metric	Rating	Comments				
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.				
		Assessment						
Domain 6: Confounding	y / Variable Co	ntrol						
Domain of Comountaing	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental				
		Design and Procedures		conditions.				
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups that could influence the outcome assessment.				
Damain 7. Data Daara								
Domain 7: Data Present	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.				
	Metric 21: Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.				
	Metric 22: Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.				
	Metric 25.	Explanation of Onexpected Outcomes	nigii	Onexpected outcomes were satisfactority explained.				
Additional Comments:	None							
Overall Quali	ty Dotorr	nination	High					

Study Citation:			f chrysotile asbestos ((CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology						
		chnical Report Series 295:1-390.								
Duration:		ation: > 21 days; Exposure Duration: > 21 day	/S							
Exposure Route,	Terrestrial; F	Food/Diet; Dietary								
Media, Path:										
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo Development/Growth									
Health Outcome:										
Chemical:	•	erpentine) (CASRN 12001-29-5)								
HERO ID:	758884									
Domain		Metric	Rating	Comments						
Domain 1: Test Substar	nce									
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.						
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).						
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.						
Domain 2: Test Design										
	Metric 4:	Negative Controls	High	Control litters from mothers were not fed asbestos.						
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported in the text without variability.						
	Metric 6:	Randomized Allocation	Medium	Adults were assigned to a treatment according to a table of random numbers.						
Domain 3: Exposure Cl	haracterization									
	Metric 7:	Experimental System/Test Media	High	Preparation of asbestos in feed adequately described.						
		Preparation								
	Metric 8:	Consistency of Exposure	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, and						
		Administration	TT: 1	the text. The amount of feed consumed is reported in Appendix H.						
	Metric 9:	Measurement of Test Substance Concentration	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysi for magnesium. Doses were described in Appendix G.						
	Metric 10:	Exposure Duration and Frequency	High	Mothers were fed asbestos four weeks prior to birthing pups.						
	Metric 11:	Number of Exposure Groups/	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only						
	wieute 11.	Spacing of Exposure Levels	14/14	one exposure concentration for both SR and IR chrysotile.						
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.						
				**						
Domain 4: Test Organis										
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.						
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.						
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.						
	Metric 15.	Replicates per Group	Wiedium	The numbers of test organisms were reported in Table 2 and were appropriate.						
		· · · · · · · · · · · · · · · · · · ·								
Domain 5: Outcome As	ssessment									
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.						
	Metric 17:	Outcome Assessment Methodology	High	Fetal weights were obtained by dividing weight of litter by number of live pups.						
		Con	tinued on next page							

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Study Citation:			of chrysotile asbestos (C	CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology		
Duration:		hnical Report Series 295:1-390. ation: > 21 days; Exposure Duration: > 21 da	avs			
Exposure Route,		Food/Diet; Dietary	uys			
Media, Path:	Terrestitui, T	ood, Diet, Dietaly				
Taxa, Species, Age:	Vertebrate: N	Mammalian; <i>Rattus norvegicus</i> ; F344/N; Emb	rvo			
Health Outcome:	Development/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	758884	r				
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	Medium	Fetal weights were determined presumably at birth.		
		Assessment				
Domain 6: Confounding	g / Variable Con Metric 19:	ntrol Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental condition or other factors that could influence the outcome assessment. Controls were housed in separate room, but conditions were the same as the treated conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	Uninformative	No statistics were performed.		
	Metric 22:	Reporting of Data	Medium	Results were presented in the text as averages and no tables or figures were provided.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	No variability was reported.		
Additional Comments:	This form ap	pplies to both short-range and intermediate-ran	nge chrysotile treatments	s in feed as well as the preweaning gavage/feed treatment group.		
	ty Detern		Uninformative			

Study Citation:		. NTP toxicology and carcinogenesis studies of ch chical Report Series 295:1-390.	rysotile asbestos	(CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology
Duration: Exposure Route,	Overall Dura	ation: > 21 days; Exposure Duration: > 21 days Food/Diet; Dietary		
Media, Path: Taxa, Species, Age:		Mammalian; Rattus norvegicus; F344/N; Embryo		
Health Outcome:	Developmen			
Chemical: HERO ID:	chrysotile (s 758884	erpentine) (CASRN 12001-29-5)		
Domain		Metric	Rating	Comments
Domain 1: Test Substanc				
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.
Domain 2: Test Design				
	Metric 4:	Negative Controls	High	Control rats received regular feed without asbestos.
	Metric 5:	Negative Control Response	High	Weights for control rats are shown in Tables 4 and 5, as well as Figures 2-3. Weights are also described in the text and they appear reasonable.
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups.
Domain 3: Exposure Cha	aracterization			
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The preparation of asbestos in feed was adequately described.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, an the text. The amount of feed consumed is reported in Appendix H.
	Metric 9:	Measurement of Test Substance Concentration	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysi for magnesium. Doses were described in Appendix G.
	Metric 10:	Exposure Duration and Frequency	High	The study was terminated for a treatment group when survival reached 10%. Data was reported for 130-141 weeks post-birth in Tables 4 and 5.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only one exposure concentration for both SR and IR chrysotile.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.
Domain 4: Test Organisr	n			
Domain 1. 105t Organisi	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
		Replicates per Group		
Domain 5: Outcome Ass	essment			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.
		Continu	ued on next page	

Study Citation:			of chrysotile asbestos (C	CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology		
Duration:		chnical Report Series 295:1-390. ation: > 21 days; Exposure Duration: > 21 da	avs			
Exposure Route,		Food/Diet; Dietary	iys			
Media, Path:	Terrestriar, T	ood, Diet, Dietaly				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F344/N; Emb	ryo			
Health Outcome:	Development/Growth					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	758884					
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest. Mean body weights were provided throughout the study for each treatment and the control.		
	Metric 18:	Consistency of Outcome Assessment	High	Rats were weighed weekly throughout the study.		
Domain 6: Confoundin	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		
Domain 7: Data Presen	tation and Anal	ysis				
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.		
	Metric 22:	Reporting of Data	High	Data for control and treatment are presented in Tables 4-5, Figures 2-3, and Appendix H.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.		

Overall Quality Determination

Uninformative

	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.							
Duration: Exposure Route,		Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Media, Path: Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo Mortality							
Health Outcome:								
Chemical:	-	Mortality chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	758884							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan								
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.				
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).				
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.				
Domain 2: Test Design								
U	Metric 4:	Negative Controls	High	Control rats received feed without asbestos.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Tables 4-8 and Table 10. It seemed reasonable for the assessed outcomes.				
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups.				
Domoin 2. Exposure Cl	anastanization							
Domain 3: Exposure Ch		Experimental System/Test Madia	High					
	Metric 7:	Experimental System/Test Media Preparation	High	The preparation of asbestos in feed was adequately described.				
	Metric 8:	Consistency of Exposure	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, and				
	methe of	Administration	mgn	the text. The amount of feed consumed is reported in Appendix H.				
	Metric 9:	Measurement of Test Substance	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysis				
		Concentration	U	for magnesium. Doses were described in Appendix G.				
	Metric 10:	Exposure Duration and Frequency	High	The study was terminated for a treatment group when survival reached 10%. Data was reported for 130-141 weeks post-birth in Tables 4 and 5.				
	Metric 11:	Number of Exposure Groups/	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only				
		Spacing of Exposure Levels		one exposure concentration for both SR and IR chrysotile.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.				
Domain 4: Test Organis	m							
0	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.				
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.				
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.				
		Replicates per Group						
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.				
	Metric 17:	Outcome Assessment Methodology	Medium	Animals were observed for mortality and any moribund rats were killed according to criteria described by the authors.				
		Cont	inued on nex	t page				

Study Citation:			es of chryso	tile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology		
Duration:	Program Technical Report Series 295:1-390. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,			uays			
Media, Path:	Terrestrial; Food/Diet; Dietary					
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo					
Health Outcome:	Mortality					
Chemical:	2	erpentine) (CASRN 12001-29-5)				
HERO ID:	758884	erpennie) (CASKIV 12001-29-5)				
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome Assessment	High	Animals were observed twice daily for mortality.		
Domain 6: Confounding	, / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	High	Statistical analysis for mortality was adequately described in methods and p-values were presented in Tables.		
	Metric 22:	Reporting of Data	High	Data was presented for control and treatment in Tables 4-8, 10. It was also described in the text.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This form ap	oplies to both short-range and intermediate-	range chrys	otile treatments in feed as well as the preweaning gavage/feed treatment group.		
Overall Qualit	y Detern	nination	High			

Study Citation: Duration:	Program Technical Report Series 295:1-390.Overall Duration: > 21 days; Exposure Duration: > 21 days							
Exposure Route,	Terrestrial; I	Food/Diet; Dietary						
Media, Path:	X7 (1 ()							
Taxa, Species, Age:		Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo Behavioral chrysotile (serpentine) (CASRN 12001-29-5)						
Health Outcome: Chemical:								
HERO ID:	758884							
Domain		Metric	Rating	Comments				
Domain 1: Test Substan	ce		U					
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.				
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).				
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Control rats received regular feed without asbestos.				
	Metric 5:	Negative Control Response	High	Food consumption for control rats is shown in Appendix H and it appears reasonable.				
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups.				
Domain 3: Exposure Ch	aracterization							
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media	High	The preparation of asbestos in feed was adequately described.				
	Wetter /.	Preparation	mgn	The preparation of assessos in feed was adequately described.				
	Metric 8:	Consistency of Exposure	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, and				
		Administration	0	the text. The amount of feed consumed is reported in Appendix H.				
	Metric 9:	Measurement of Test Substance	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysis				
		Concentration		for magnesium. Doses were described in Appendix G.				
	Metric 10:	Exposure Duration and Frequency	High	The study was terminated for a treatment group when survival reached 10%. Data was reported for 130-141 weeks post-birth in Tables 4 and 5.				
	Metric 11:	Number of Exposure Groups/	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only				
		Spacing of Exposure Levels		one exposure concentration for both SR and IR chrysotile.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.				
Domain 4: Test Organis	m							
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.				
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.				
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.				
		Replicates per Group						
Domain 5: Outcome As	sessment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.				
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest. Food consumption reported weekly throughout the study for each treatment and the control.				
		<u> </u>	nued on next page					

Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology					
	Program Technical Report Series 295:1-390.					
Duration:		ation: > 21 days; Exposure Duration: > 21 d	lays			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo					
Health Outcome:	Behavioral					
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)				
HERO ID:	758884					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Food consumed was reported as per day on a weekly basis.		
		Assessment				
Domain 6: Confounding	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental condition		
		Design and Procedures		or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		
Domain 7: Data Present	ation and Anal	vsis				
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.		
	Metric 22:	Reporting of Data	High	Data for control and treatment are presented in Appendix H and briefly mentioned in th text of results.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.		
	TI: C		1 (1) ()			
Additional Comments:	This form ap	pplies to both short-range and intermediate-ra	ange chrysotile treatment	s in feed as well as the preweaning gavage/feed treatment group.		
Overall Quali	tv Deterr	nination	Uninformative	e		

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	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology					
	Program Technical Report Series 295:1-390. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,		Food/Diet; Dietary	5			
Media, Path:	Terrestriar, I	ood/Diet, Dietary				
Taxa, Species, Age:	Vertebrate: N	Mammalian; Rattus norvegicus; F344/N; Adult				
Health Outcome:		e/Teratogenic				
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	758884					
Domain		Metric	Rating	Comments		
Domain 1: Test Substance	e		U			
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.		
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).		
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.		
Domain 2: Test Design						
U	Metric 4:	Negative Controls	High	Control litters from mothers were not fed asbestos.		
	Metric 5:	Negative Control Response	Medium	The biological response of the negative control group was reported in the text without variability.		
	Metric 6:	Randomized Allocation	Medium	Adults were assigned to a treatment according to a table of random numbers.		
Domain 3: Exposure Char						
	Metric 7:	Experimental System/Test Media	High	The preparation of asbestos in feed was adequately described.		
	M (' 0	Preparation	TT' 1			
	Metric 8:	Consistency of Exposure	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, ar the text. The amount of feed consumed is reported in Appendix H.		
	Metric 9:	Administration Measurement of Test Substance	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysi		
	Wieurie 9.	Concentration	Ingn	for magnesium. Doses were described in Appendix G.		
	Metric 10:	Exposure Duration and Frequency	High	Mothers were fed asbestos four weeks prior to birthing pups.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only one exposure concentration for both SR and IR chrysotile.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.		
Domain 4: Test Organism	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.		
	Metric 13: Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.		
	Metric 14.	Conditions	nigii	Adult fats of F0 generation were acclimated 4-5 weeks prior to testing.		
	Metric 15:	Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.		
		Replicates per Group				
Domain 5: Outcome Asse	essment					
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.		
	Metric 17:	Outcome Assessment Methodology	High	Litter size from each treatment was determined.		
	Metric 18:	Consistency of Outcome Assessment	Medium	Litter size was determined presumably prior to culling.		
			tinued on next page			

Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.					
Duration:		tion: > 21 days; Exposure Duration: > 21 da	iys			
Exposure Route,		ood/Diet; Dietary	-			
Media, Path:						
axa, Species, Age: Vertebrate; Mammalian; Rattus norvegicus; F344/N; Adult						
Health Outcome:						
Chemical: chrysotile (serpentine) (CASRN 12001-29-5)						
HERO ID:	758884					
Domain		Metric	Rating	Comments		
Domain Domain 6: Confoundin	Metric 19:	ntrol Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.		
	0	ntrol Confounding Variables in Test		There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a		
	Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions. Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent		
Domain 6: Confoundin	Metric 19: Metric 20:	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure	High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions. Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent		
Domain 6: Confoundin	Metric 19: Metric 20: tation and Anal	ntrol Confounding Variables in Test Design and Procedures Outcomes Unrelated to Exposure ysis	High High	There were no reported differences among the study groups in environmental conditions or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions. Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		

Overall Quality Determination

Uninformative

Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.								
Duration:	Overall Dura	ation: $> 2\hat{1}$ days; Exposure Duration: > 2	1 days						
Exposure Route,	Terrestrial; I	Food/Diet; Dietary							
Media, Path:	Vartabrata: N	ertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo							
Taxa, Species, Age: Health Outcome:	Cancer/Carc		mbryo						
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)								
HERO ID:	758884								
Domain		Metric	Rating	Comments					
Domain 1: Test Substand		Test Sectores Islandites	II: -L						
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	High High	Chemical was identified by name and CAS number. Source was stated and chrysotile analytically verified (Table 1).					
	Metric 2: Metric 3:	Test Substance Purity	High	Source was stated and chrysotile anaryticany vermed (rable 1). SR and IR chrysotile were both detected at greater than 96% by volume.					
	incure 5.		ingn						
Domain 2: Test Design			TT' 1						
	Metric 4:	Negative Controls	High	Control rats received feed without asbestos.					
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported in Tables 11-16 and in the text of the results.					
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups.					
Domain 3: Exposure Ch	aracterization								
-	Metric 7:	Experimental System/Test Media Preparation	High	The preparation of asbestos in feed was adequately described.					
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, and the text. The amount of feed consumed is reported in Appendix H.					
	Metric 9:	Measurement of Test Substance	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysis					
	Matria 10.	Concentration	Uich	for magnesium. Doses were described in Appendix G.					
	Metric 10: Metric 11:	Exposure Duration and Frequency Number of Exposure Groups/	High N/A	The study was terminated for a treatment group when survival reached 10%. The goal was not to have a dose-dependent effect. This was a lifetime study with only					
	mente 11.	Spacing of Exposure Levels	11/11	one exposure concentration for both SR and IR chrysotile.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.					
Domain 4: Test Organisi	n								
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.					
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.					
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.					
Domain 5: Outcome Ass	sessment	· · ·							
2 chain 5. Outcome Also	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.					
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest and is described in the Methods and Table 3. Lesion examination was described well, especially for the gastrointestinal tract.					
		Cont	inued on nex	t nage					

Study Citation:	NTP, (1985)	. NTP toxicology and carcinogenesis studie	es of chryso	tile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicolog		
	Program Technical Report Series 295:1-390.					
Duration:		ation: > 21 days; Exposure Duration: > 21	days			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo					
Health Outcome:	Cancer/Carcinogenesis					
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)				
HERO ID:	758884					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome	High	Animals were observed twice daily for moribund conditions and terminated if moribund.		
		Assessment		Necropsy and histological examinations were performed on those animals and on any remaining animals at the conclusion of the study.		
Domain 6: Confounding	r / Variable Cor	ntrol				
c c	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental conditions		
		Design and Procedures	U	or other factors that could influence the outcome assessment. Controls were housed in a		
		C		separate room, but conditions were the same as the treated conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.		
Domain 7: Data Present		5				
	Metric 21:	Statistical Methods	High	Three different methods of statistical analysis for lesion/cancer occurrence were de- scribed.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented in text of Results, Tables 11-16, and in the Appendices.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
	This form ar	polies to both short-range and intermediate-	range chrys	otile treatments in feed as well as the preweaning gavage/feed treatment group.		
Additional Comments:	This form up	plies to bour short range and intermediate		the deductions in feed as wen as the preveating gavage, feed deduction group.		

Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.							
Duration: Exposure Route,	Overall Dura	ation: > 21 days; Exposure Duration: > 21 days Food/Diet; Dietary						
Media, Path:								
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo							
Health Outcome:		Immune/Hematological						
Chemical: HERO ID:	chrysotile (serpentine) (CASRN 12001-29-5) 758884							
Domain		Metric	Rating	Comments				
Domain 1: Test Substanc								
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.				
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).				
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.				
Domain 2: Test Design								
-	Metric 4:	Negative Controls	High	Control rats received regular feed without asbestos.				
	Metric 5:	Negative Control Response	High	Pathological burden was shown in the Appendices and described in Table D.				
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups.				
Domain 3: Exposure Cha	aracterization							
Domain 5. Exposure en	Metric 7:	Experimental System/Test Media Preparation	High	The preparation of asbestos in feed was adequately described.				
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, ar the text. The amount of feed consumed is reported in Appendix H.				
	Metric 9:	Measurement of Test Substance Concentration	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysi for magnesium. Doses were described in Appendix G.				
	Metric 10:	Exposure Duration and Frequency	High	The study was terminated for a treatment group when survival reached 10%. Data was reported for 130-141 weeks post-birth in Tables 4 and 5.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only one exposure concentration for both SR and IR chrysotile.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.				
Domain 4: Test Organisr	n							
c	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.				
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.				
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.				
		Replicates per Group						
Domain 5: Outcome Ass	essment							
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.				
	Metric 17:	Outcome Assessment Methodology	Low	Few details were provided on the methodology for identifying parasites/infections.				
		Contin	ued on next page					

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Study Citation:		e. e	of chrysotile asbestos (C	CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology	
		chnical Report Series 295:1-390.			
Duration:		ation: > 21 days; Exposure Duration: > 21 da	ays		
Exposure Route,	Terrestrial; F	Food/Diet; Dietary			
Media, Path:					
Taxa, Species, Age:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F344/N; Embryo				
Health Outcome:	Immune/Her	6			
Chemical:	chrysotile (se	erpentine) (CASRN 12001-29-5)			
HERO ID:	758884				
Domain		Metric	Rating	Comments	
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for outcome assessment (e.g.,	
		Assessment		timing of assessment across groups) were confusing, limited, or not reported.	
Domain 6: Confounding	y / Variable Co	ntrol			
Domain o. Comounding	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental condition	
	incure 19.	Design and Procedures	ing.	or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.	
Domain 7: Data Present	ation and Anal	vsis			
Domain 7. Dua Proson	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.	
	Metric 22:	Reporting of Data	High	Data for randomly sampled rats are presented in Appendices and as percentages in Tabl D.	
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.	
Additional Comments:	This form ar	polies to both short-range and intermediate-ra	nge chrysotile treatment	s in feed as well as the preweaning gavage/feed treatment group.	
ruantonui Commento.	rins torin ap	spice to boar short range and intermediate-rai	inge ein ysourie acathlent.	s in reed as went as the preweating garageriedd reachent group.	
Overall Qualit	t v Deter n	nination	Uninformative	2	

Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology Program Technical Report Series 295:1-390.								
Duration: Exposure Route,	Overall Dura	ation: > 21 days; Exposure Duration: > 21 days Food/Diet; Dietary							
Media, Path:		Vertebrate; Mammalian; Rattus norvegicus; F344/N; Adult							
Taxa, Species, Age:									
Health Outcome:		Immune/Hematological							
Chemical: HERO ID:	chrysotile (s 758884	erpentine) (CASRN 12001-29-5)							
Domain		Metric	Rating	Comments					
Domain 1: Test Substand									
	Metric 1:	Test Substance Identity	High	Chemical was identified by name and CAS number.					
	Metric 2:	Test Substance Source	High	Source was stated and chrysotile analytically verified (Table 1).					
	Metric 3:	Test Substance Purity	High	SR and IR chrysotile were both detected at greater than 96% by volume.					
Domain 2: Test Design									
	Metric 4:	Negative Controls	High	Control rats received regular feed without asbestos.					
	Metric 5:	Negative Control Response	High	Pathological burden was shown in the Appendices and described in Table D.					
	Metric 6:	Randomized Allocation	Medium	Allocation was performed with an unbiased method with a nonrandom component to ensure distribution across groups					
Domain 3: Exposure Ch	aracterization								
	Metric 7:	Experimental System/Test Media Preparation	High	The preparation of asbestos in feed was adequately described.					
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were consistent and reported in Figure 1, Table 3, and the text. The amount of feed consumed is reported in Appendix H.					
	Metric 9:	Measurement of Test Substance Concentration	High	Each lot of feed was measured for asbestos concentration via atomic absorption analysi for magnesium. Doses were described in Appendix G.					
	Metric 10:	Exposure Duration and Frequency	High	The study was terminated for a treatment group when survival reached 10%. Data was reported for 130-141 weeks post-birth in Tables 4 and 5.					
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	The goal was not to have a dose-dependent effect. This was a lifetime study with only one exposure concentration for both SR and IR chrysotile.					
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos exposure was via diet.					
Domain 4: Test Organisi	n								
-	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.					
	Metric 14:	Acclimatization and Pretreatment	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.					
	Metric 15:	Conditions Number of Organisms and	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.					
		Replicates per Group							
Domain 5: Outcome Ass									
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.					
	Metric 17:	Outcome Assessment Methodology	Low	Few details were provided on the methodology for identifying parasites/infections.					
			nued on next page						

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Study Citation:	NTP, (1985). NTP toxicology and carcinogenesis studies of chrysotile asbestos (CAS no. 12001-29-5) in F344/N rats (feed studies). National Toxicology			
		chnical Report Series 295:1-390.		
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days			
Exposure Route,	Terrestrial; Food/Diet; Dietary			
Media, Path:				
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; F344/N; Adult			
Health Outcome:	Immune/Hematological			
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)			
HERO ID:	758884			
Domain		Metric	Rating	Comments
	Metric 18:	Consistency of Outcome	Low	Details regarding the execution of the study protocol for outcome assessment (e.g.,
		Assessment		timing of assessment across groups) were confusing, limited, or not reported.
Domain 6: Confounding	y / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test	High	There were no reported differences among the study groups in environmental condition
		Design and Procedures	8	or other factors that could influence the outcome assessment. Controls were housed in a separate room, but conditions were the same as the treated conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition in each group was reported in Tables 4-8 and 10 and there were no apparent non-treatment differences that would affect the outcome.
Domain 7: Data Present	tation and Anal	vsis		
	Metric 21:	Statistical Methods	Uninformative	Statistics were not performed.
	Metric 22:	Reporting of Data	High	Data for randomly sampled rats are presented in Appendices and as percentages in Tabl D.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.
Additional Comments:	This form ar	polies to both short-range and intermediate-ran	nge chrysotile treatment	s in feed as well as the preweaning gavage/feed treatment group.
	1 no rom up			
Overall Quali	tv Deterr	nination	Uninformativ	e

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Asbestos

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies). Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary						
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Reproductiv	Mammalian; <i>Rattus norvegicus</i> ; F300/N; N e/Teratogenic Inerite) (CASRN 12172-73-5)	ot Applicable	e (e.g., fungi or algae studies) or Not Reported				
Domain	756901	Metric	Rating	Comments				
Domain 1: Test Substan	ce	Wette	Kating	Comments				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and com- position.				
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer. The type and region of origin were specifically identified.				
	Metric 3:	Test Substance Purity	High	The test substance purity and composition were identified such that any observed effects were highly likely to be due to the nominal test substance itself.				
Domain 2: Test Design								
	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.				
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.				
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.				
Domain 3: Exposure Ch	aracterization							
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.				
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups.				
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.				
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.				
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one asbestos concentration tested.				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.				
Domain 4: Test Organis	m							
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.				
	Metric 14:	Acclimatization and Pretreatment Conditions	High	All pretreatment conditions were the same for control and exposed organisms.				
	Metric 15:	Number of Organisms and Replicates per Group	Medium	An adequate number of organisms were used. Individuals were used as replicates.				

		contin	nued from p	previous page			
Study Citation:	NTP, (1990)	. Toxicology and carcinogenesis studies of	amosite asb	estos (CAS no. 12172-73-5) in F344/N rats (feed studies).			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Terrestrial; F	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Health Outcome:	Reproductive/Teratogenic						
Chemical:	amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	758961						
Domain		Metric	Rating	Comments			
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
Domain 6: Confounding	y / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Qualit	ty Detern	nination	High				

Asbestos

Study Citation: Duration: Exposure Route, Madia Bathy	ion:Overall Duration: > 21 days; Exposure Duration: > 21 daysure Route,Terrestrial; Food/Diet; Dietary					
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Behavioral	Mammalian; <i>Rattus norvegicus</i> ; F300/N; N inerite) (CASRN 12172-73-5)	lot Applicable	e (e.g., fungi or algae studies) or Not Reported		
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and com- position.		
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer. The type and region of origin were specifically identified.		
	Metric 3:	Test Substance Purity	High	The test substance purity and composition were identified such that any observed effects were highly likely to be due to the nominal test substance itself.		
Domain 2: Test Design						
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.		
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.		
Domain 2: Exposure Ch	orectorization					
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in		
		Preparation	c	adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.		
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one asbestos concentration tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.		
Domain 4: Test Organisi	m					
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	An adequate number of organisms were used. Individuals were used as replicates.		
		· · ·				
Domain 5: Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.		
		Cont	tinued on nex			
		Con	inueu on nex	11 page		

		conti	nued from p	previous page			
Study Citation:	NTP, (1990)	. Toxicology and carcinogenesis studies of	amosite asbe	estos (CAS no. 12172-73-5) in F344/N rats (feed studies).			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F300/N; N	ot Applicable	e (e.g., fungi or algae studies) or Not Reported			
Health Outcome:	Behavioral						
Chemical:	amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	758961						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	lysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	For food cor	nsumption see Appendix H.					
Overall Qualit	ty Deterr	nination	High				

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Study Citation: Duration: Exposure Route, Madia Bathy	Overall Dura	. Toxicology and carcinogenesis studies of ation: > 21 days; Exposure Duration: > 2 Food/Diet; Dietary		estos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mortality	Mammalian; <i>Rattus norvegicus</i> ; F300/N; N Inerite) (CASRN 12172-73-5)	Not Applicable	e (e.g., fungi or algae studies) or Not Reported
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and com- position.
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer. The type and region of origin were specifically identified.
	Metric 3:	Test Substance Purity	High	The test substance purity and composition were identified such that any observed effects were highly likely to be due to the nominal test substance itself.
Domain 2: Test Design				
6	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 2: Exposure Ch	araatarization			
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	High	The experimental system and methods for preparation of test media were described in
		Preparation	Ū.	adequate detail.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one asbestos concentration tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.
Domain 4: Test Organis				
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	An adequate number of organisms were used. Individuals were used as replicates.
		· · ·		
Domain 5: Outcome Ass	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.
		Cont	tinued on nex	
		Con	indea on nex	n page

		contin	nued from p	previous page			
Study Citation:	NTP, (1990)	. Toxicology and carcinogenesis studies of	amosite asb	estos (CAS no. 12172-73-5) in F344/N rats (feed studies).			
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days				
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F300/N; No	ot Applicabl	e (e.g., fungi or algae studies) or Not Reported			
Health Outcome:	Mortality						
Chemical:	amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	758961						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
Domain 6: Confounding	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Qualit	ty Detern	nination	High				

Study Citation: Duration: Exposure Route, Madia Datha	Overall Dur	 Toxicology and carcinogenesis studies o ation: > 21 days; Exposure Duration: > 2 Food/Diet; Dietary 		estos (CAS no. 12172-73-5) in F344/N rats (feed studies).		
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported Cancer/Carcinogenesis amosite (grunerite) (CASRN 12172-73-5) 758961					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and com- position.		
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer. The type and region of origin were specifically identified.		
	Metric 3:	Test Substance Purity	High	The test substance purity and composition were identified such that any observed effects were highly likely to be due to the nominal test substance itself.		
Domain 2: Test Design						
U	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.		
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.		
Domain 3: Exposure Ch			TT: -1-			
	Metric 7:	Experimental System/Test Media Preparation	High	The experimental system and methods for preparation of test media were described in adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.		
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one asbestos concentration tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.		
Domain 4: Test Organis						
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	An adequate number of organisms were used. Individuals were used as replicates.		
Domain 5: Outcome As	sessment					
Domain 5. Outcome As	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.		
		C	tinued on nex			

Overall Qualit	ty Detern	nination	High				
Additional Comments:	Various neop	plasms, lesions, and other pathologies were	reported.				
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
Domain 6: Confounding							
		Assessment					
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
Domain		Metric	Rating	Comments			
Chemical: HERO ID:	amosite (grunerite) (CASRN 12172-73-5) 758961						
Health Outcome:	Cancer/Carcinogenesis						
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported						
Media, Path:							
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).						

Asbestos

Study Citation: Duration: Exposure Route, Madia Pathy	Overall Dur). Toxicology and carcinogenesis studies o ation: > 21 days; Exposure Duration: > 2 Food/Diet; Dietary		estos (CAS no. 12172-73-5) in F344/N rats (feed studies).		
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported Development/Growth amosite (grunerite) (CASRN 12172-73-5) 758961					
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and com- position.		
	Metric 2:	Test Substance Source	High	The source of the test substance was reported as a manufacturer. The type and region of origin were specifically identified.		
	Metric 3:	Test Substance Purity	High	The test substance purity and composition were identified such that any observed effects were highly likely to be due to the nominal test substance itself.		
Domain 2: Test Design						
C	Metric 4:	Negative Controls	High	Study authors reported using an appropriate concurrent negative control group.		
	Metric 5:	Negative Control Response	High	The biological response of the negative control group was reported and reasonable for assessed outcomes.		
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.		
	, . <i>.</i> .					
Domain 3: Exposure Ch	Metric 7:	Experimental System/Test Media	Ulah	The experimental system and methods for preparation of test media were described in		
		Preparation	High	adequate detail.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups.		
	Metric 9:	Measurement of Test Substance Concentration	High	Exposure concentrations were measured using appropriate analytical technologies and methods.		
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one asbestos concentration tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet and/or gavage.		
Domain 4: Test Organis	m					
	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.		
	Metric 14:	Acclimatization and Pretreatment	High	All pretreatment conditions were the same for control and exposed organisms.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Medium	An adequate number of organisms were used. Individuals were used as replicates.		
Domain 5: Outcome Ass	sessment					
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.		
		Cont	tinued on nex	t pogo		

		contir	nued from p	previous page			
Study Citation:	NTP, (1990)	. Toxicology and carcinogenesis studies of	amosite asb	estos (CAS no. 12172-73-5) in F344/N rats (feed studies).			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Terrestrial; Food/Diet; Dietary						
Media, Path:							
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F300/N; No	ot Applicable	e (e.g., fungi or algae studies) or Not Reported			
Health Outcome:	Development/Growth						
Chemical:	amosite (grunerite) (CASRN 12172-73-5)						
HERO ID:	758961						
Domain		Metric	Rating	Comments			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.			
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.			
Domain 6: Confounding	g / Variable Cor	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	High	There were no reported differences among the study groups in environmental conditions.			
	Metric 20:	Outcomes Unrelated to Exposure	High	There were no differences among groups.			
Domain 7: Data Present	ation and Anal	ysis					
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.			
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.			
Additional Comments:	None						
Overall Qualit	ty Detern	nination	High				

Study Citation:			e e	fibres in rats. IARC Scientific Publication no. 90 :127-133.			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days						
Exposure Route,	Terrestrial; I	Food/Diet; Dietary					
Media, Path:							
Taxa, Species, Age:	Vertebrate; I	Mammalian; Rattus norvegicus; Wistar Han SH	PF; Not Applicable (e.	g., fungi or algae studies) or Not Reported			
Health Outcome:	Developmer	nt/Growth					
Chemical:	chrysotile (s	serpentine) (CASRN 12001-29-5)					
HERO ID:	759022						
Domain		Metric	Rating	Comments			
Domain 1: Test Substan	ce						
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.			
	Metric 2:	Test Substance Source	High	Source was stated.			
	Metric 3:	Test Substance Purity	Medium	Chrysotile was UICC granulometry.			
Domain 2: Test Design							
2 olimin 2. Test Design	Metric 4:	Negative Controls	High	Control groups included palm-oil without asbestos and no palm-oil.			
	Metric 5:	Negative Control Response	Medium	Weights of the control groups are shown in Table 1. Control rats with palm-oil were			
	metric 5.	Regarive Control Response	Weddulli	heavier than no palm-oil controls during the dosing period.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups, only that the were distributed.			
Domain 3: Exposure Ch	oractorization						
Domain 5. Exposure Ci	Metric 7:	Experimental System/Test Media	Medium	The study provided some details on the measures taken to appropriately prepare test			
	Wieuric 7.	Preparation	Medium	concentrations.			
	Metric 8:	Consistency of Exposure	High	Exposures were administered consistently across study groups.			
	Metric 9:	Administration Measurement of Test Substance	Medium	The amount ingested was measured, but not the actual asbestos content.			
	M 10	Concentration	TT' 1	T			
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for chronic study.			
	Metric 11:	Number of Exposure Groups/	High	The number of exposure groups and spacing of exposure levels were suitable.			
		Spacing of Exposure Levels	U				
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.			
Domain 4: Test Organis	m						
Domain 4. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source			
	Metric 13: Metric 14:	Acclimatization and Pretreatment	High	The test organisms were acclimatized one week prior to testing.			
	Metric 15:	Conditions Number of Organisms and	Low	Each treatment group consisted of 140 rats (70 male, 70 female).			
	wiedle 15.	Replicates per Group	Low	Lach treathent group consisted of 140 fats (70 mate, 70 female).			
Domain 5: Outcome As	sessment						
	Metric 16:	Adequacy of Test Conditions	Low	The study was conducted according to OECD 451. However, these details were not specified in the study.			
		Co	ntinued on next page				
			1.0				

		co	ontinued from previous p	page		
Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Developmen	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported Development/Growth chrysotile (serpentine) (CASRN 12001-29-5) 759022				
Domain		Metric	Rating	Comments		
	Metric 17:	Outcome Assessment Methodology	Medium	The study was conducted according to OECD 451. However, details of weighing aside from time-points was not specified in the study.		
	Metric 18:	Consistency of Outcome Assessment	High	Weights were obtained at 12, 24, and 30 months.		
Domain 6: Confounding	g / Variable Coi	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported in Table 1. There were no differences that could influence the outcome assessment.		
Domain 7: Data Present	ation and Anal	ysis				
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis between the palm oil control and asbestos-treated groups (vehicle was palm oil) was not performed.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 1.		
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability was not reported.		
Additional Comments:	This form ap	plies to both the chrysotile-only and chrysoti	ile+crocidolite mixture tre	eatments.		
Overall Qualit	ty Detern	nination	Uninformative	9		

Study Citation: Duration: Exposure Route, Media, Path:	:Overall Duration: > 21 days; Exposure Duration: > 21 days:Content::::<				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported Cancer/Carcinogenesis chrysotile (serpentine) (CASRN 12001-29-5) 759022				
Domain		Metric	Rating	Comments	
Domain 1: Test Substan	ce				
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.	
	Metric 2:	Test Substance Source	High	Source of chemical was stated.	
	Metric 3:	Test Substance Purity	Medium	Chrysotile was UICC granulometry.	
Domain 2: Test Design					
_ , 1000 _ 001gh	Metric 4:	Negative Controls	High	Control groups included palm-oil without asbestos and no palm-oil.	
	Metric 5:	Negative Control Response	Medium	Tumor results for control groups are shown in Table 2. Authors noted that the proportion of animals with tumors is high but consistent with previous literature.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups, only that they were distributed.	
Domain 3: Exposure Ch	aracterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.	
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.	
	Metric 9:	Measurement of Test Substance Concentration	Medium	The amount ingested was measured, but not the actual asbestos content.	
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for a chronic exposure.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Three doses of chrysotile only or chrysotile+crocidolite were utilized (10, 60, and 360 mg/day).	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.	
Domain 4: Test Organis	m				
Domain 1. Test Organis	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.	
	Metric 14:	Acclimatization and Pretreatment	High	The test organisms were adequacily described and were obtained from a remable source. The test organisms were acclimatized one week prior to testing.	
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	Each treatment group consisted of 140 rats (70 male, 70 female).	
Domain 5: Outcome Ass	agamant				
Domain 5. Outcome Ass	Metric 16:	Adequacy of Test Conditions	Low	The study was conducted according to OECD 451. However, these details were not specified in the study.	
	Metric 17:	Outcome Assessment Methodology	Low	The study was conducted according to OECD 451. However, no details were provided of how tumor types were determined.	

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Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Food/Diet; Dietary				
Taxa, Species, Age:	· · · · · · · · · · · · · · · · · · ·	Vertebrate; Mammalian; <i>Rattus norvegicus</i> ; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported				
Health Outcome:	Cancer/Carcinogenesis					
Chemical:	•	chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	759022					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome Assessment	Low	The study was conducted according to OECD 451; however, no details of timing of assessment were provided in this study.		
Domain 6: Confoundin	g / Variable Co	ntrol				
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
				conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for each study group. There were no differences among groups that could influence the outcome assessment.		
Domain 7: Data Presen		Outcomes Unrelated to Exposure	High	Attrition was reported for each study group. There were no differences among groups		
Domain 7: Data Presen		Outcomes Unrelated to Exposure	High	Attrition was reported for each study group. There were no differences among groups		
Domain 7: Data Presen	tation and Anal	Outcomes Unrelated to Exposure ysis		Attrition was reported for each study group. There were no differences among groups that could influence the outcome assessment.		

Overall Quality Determination

Medium

Study Citation: Duration: Exposure Route, Media, Path:	Duration: Overall Duration: > 21 days; Exposure Duration: > 21 days Exposure Route, Terrestrial; Food/Diet; Dietary Media, Path: Image: Species, Age: Vertebrate; Mammalian; Rattus norvegicus; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported Image: Path: Image: Species, Age: Vertebrate; Mammalian; Rattus norvegicus; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported Image: Path: Image: Chemical: Chemical: Outcome: Chemical: Chemical: Outcome: Chemical: Chemical:			
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:				
Domain		Metric	Rating	Comments
Domain 1: Test Substanc	e			
	Metric 1:	Test Substance Identity	Low	No CASRN was provided.
	Metric 2:	Test Substance Source	High	Source was stated.
	Metric 3:	Test Substance Purity	Medium	Chrysotile was UICC granulometry.
Domain 2: Test Design				
Bonnani 21 Teor Beorgi	Metric 4:	Negative Controls	High	Control groups included palm-oil without asbestos and no palm-oil.
	Metric 5:	Negative Control Response	High	Control survival was reported in the text and in Table 1. The results appeared reasonable.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups, only that they were distributed.
Domain 3: Exposure Cha	aracterization			
Domain 9. Exposure en	Metric 7:	Experimental System/Test Media Preparation	Medium	The study provided some details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	The amount ingested was measured, but not the actual asbestos content.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for a chronic study.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were suitable.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organisn	n			
Domain 1. 10st Organish	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized one week prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Low	Each treatment group consisted of 140 rats (70 male, 70 female).
Domain 5: Outcome Ass	essment			
	Metric 16:	Adequacy of Test Conditions	Low	The study was conducted according to OECD 451. However, these details were not specified in the study.
	Metric 17:	Outcome Assessment Methodology	Medium	The study was conducted according to OECD 451; however no details of mortality observations, aside from time points, were provided in Table 1.
		C.	ontinued on next page	-

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		co	ntinued from previous	page		
Study Citation:				pres in rats. IARC Scientific Publication no. 90 :127-133.		
Duration:	Overall Dura	ation: > 21 days; Exposure Duration: > 21 days	ays			
Exposure Route,	Terrestrial; F	Food/Diet; Dietary				
Media, Path:						
Taxa, Species, Age:	Vertebrate; N	Vertebrate; Mammalian; Rattus norvegicus; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported				
Health Outcome:	Mortality	Mortality				
Chemical:	chrysotile (s	chrysotile (serpentine) (CASRN 12001-29-5)				
HERO ID:	759022					
Domain		Metric	Rating	Comments		
	Metric 18:	Consistency of Outcome Assessment	Medium	It was not reported how often animals were assessed for mortality. Cumulative survival was reported at 24 and 30 months.		
Domain 6: Confoundin	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions.		
	Metric 20:	Outcomes Unrelated to Exposure	High	Attrition was reported for each treatment group (Table 1 and text).		
Domain 7: Data Presen	tation and Anal	vsis				
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not performed.		
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Table 1.		
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.		
Additional Comments:	This form ap	pplies to both the chrysotile-only and chrysoti	le+crocidolite mixture tr	eatments.		
Overall Quali	ty Detern	nination	Uninformative			

Study Citation: Duration: Exposure Route,	ion:Overall Duration: > 21 days; Exposure Duration: > 21 daysure Route,Terrestrial; Food/Diet; Dietary, Path:Comparison of the state o				
Media, Path: Taxa, Species, Age:					
Health Outcome:	Other (pleas	e specify below) (Choking)			
Chemical:	chrysotile (s	erpentine) (CASRN 12001-29-5)			
HERO ID:	3612470				
Domain		Metric	Rating	Comments	
Domain 1: Test Substand			_		
	Metric 1:	Test Substance Identity	Low	The chemical was identified by name only.	
	Metric 2:	Test Substance Source	Low	The source was not reported.	
	Metric 3:	Test Substance Purity	Low	Purity or grade of test substance was not reported.	
Domain 2: Test Design					
2011an <u>-</u> 1000 2004gu	Metric 4:	Negative Controls	Uninformative	The study was conducted with three different types of feed - a cellulose diet, asbestos diet, and standard diet. Each type of feed had different percentages of dry matter, nitrogen, crude protein, ether extract, ash, and energy (for cellulose and asbestos). The study was designed to evaluate regurgitation and choking in rats but the study authors did not attempt to normalize or explain why three distinct types of feed were used. It is not possible to make conclusions without taking the feed differences into consideration Additionally, the study authors observed differences between male and female rats regardless of the type of feed. It is unclear what role asbestos played in this study, if any.	
	Metric 5:	Negative Control Response	High	The biological response of the negative control groups was reported and reasonable.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how organisms were allocated to study groups.	
Domain 3: Exposure Ch	aracterization				
Domain 5. Exposure Ch	Metric 7:	Experimental System/Test Media	Low	The study provided only limited details on the measures taken to appropriately prepare	
	Weate 7.	Preparation	Low	test concentrations.	
	Metric 8:	Consistency of Exposure	Medium	The consistency is questionable with ad libitum offering of food.	
	Metric 9:	Administration Measurement of Test Substance	Low	Exposure concentrations were not measured.	
	Metric 10:	Concentration Exposure Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one treatment level was used.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.	
Domain 4: Test Organisi	n				
Bomain 1. 10st Organisi	Metric 13:	Test Organism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source	
	Metric 13: Metric 14:	Acclimatization and Pretreatment	Low	The study did not report whether test organisms were acclimatized.	
	Meure 14.	Conditions	Low	The study are not report whether test organisms were accumatized.	
		C	ontinued on next page .		

Study Citation:	Will, L. A., I	Leininger, J. R., Donham, K. J. (1979). Regur	gitation and choke in rat	s. Laboratory Animal Science 29(3):360-363.
Duration:		ation: > 21 days; Exposure Duration: > 21 days	•	
Exposure Route,		Food/Diet; Dietary	,	
Media, Path:				
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F344 male; N	ot Applicable (e.g., fung	i or algae studies) or Not Reported
Health Outcome:	Other (please	e specify below) (Choking)		
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)			
HERO ID:	3612470			
Domain		Metric	Rating	Comments
	Metric 15:	Number of Organisms and	Medium	A suitable number was used. Individuals could serve as replicates.
		Replicates per Group		
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment		
Domain 6: Confounding	g / Variable Cor	ntrol		
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmen
		Design and Procedures		conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Low	There were reported differences between male and female rats with no explanation as to why that might have occurred, regardless of what the feed contained.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.
Additional Comments:		existed in the types of feed used as well as ma at all. Results of a mixture were also reported		nclear the extent asbestos contributed to the choking played in the study
Overall Qualit	v Detern	nination	Uninformative	2

Asbestos

Study Citation:	Will, L. A., Leininger, J. R., Donham, K. J. (1979). Regurgitation and choke in rats. Laboratory Animal Science 29(3):360-363.					
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; Food/Diet; Dietary					
Media, Path:	•					
Taxa, Species, Age:	Vertebrate; Mammalian; Rattus norvegicus; F3	44 female; Not Applicable (e.g., fungi or algae st	udies) or Not Reported			
Health Outcome:	Other (please specify below) (Choking)					
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)					
HERO ID:	3612470					
Domain	Matria	Dating	Commonte			

Metric 2: Test Substa Metric 3: Test Substa Domain 2: Test Design Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat	nce Identity		
Metric 2: Metric 3: Test Substa Domain 2: Test Design Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Metric 8: Consistency Administrat	-		
Metric 3: Test Substa Domain 2: Test Design Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Metric 8: Consistency Administrat Administrat		Low	The chemical was identified by name only.
Domain 2: Test Design Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat	nce Source	Low	The source was not reported.
Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat	nce Purity	Low	Purity or grade of test substance was not reported.
Metric 4: Negative Co Metric 5: Negative Co Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat			
Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat	ontrols	Uninformative	The study was conducted with three different types of feed - a cellulose diet, asbestos diet, and standard diet. Each type of feed had different percentages of dry matter, nitrogen, crude protein, ether extract, ash, and energy (for cellulose and asbestos). The study was designed to evaluate regurgitation and choking in rats but the study authors did not attempt to normalize or explain why three distinct types of feed were used. It is not possible to make conclusions without taking the feed differences into consideration Additionally, the study authors observed differences between male and female rats regardless of the type of feed. It is unclear what role asbestos played in this study, if any.
Metric 6: Randomized Domain 3: Exposure Characterization Metric 7: Experiment Preparation Metric 8: Consistency Administrat	ontrol Response	High	The biological response of the negative control groups was reported and reasonable.
Metric 7: Experiment Preparation Metric 8: Consistency Administrat	ed Allocation	Low	Researchers did not report how organisms were allocated to study groups.
Metric 7: Experiment Preparation Metric 8: Consistency Administrat			
Metric 8: Consistency Administrat			
Administrat		Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.
Metric 9: Measureme	y of Exposure	Medium	The consistency is questionable with ad libitum offering of food.
a	ent of Test Substance	Low	Exposure concentrations were not measured.
Metric 10: Concentrati Exposure D	ion Duration and Frequency	High	The duration of exposure and/or exposure frequency were reported and appropriate for the study type.
	Exposure Groups/	N/A	Only one treatment level was used.
	Exposure Levels or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism			
6	ism Characteristics	High	The test organisms were adequately described and were obtained from a reliable source
-	ation and Pretreatment	Low	The study did not report whether test organisms were acclimatized.
Conditions		Medium	A suitable number was used. Individuals could serve as replicates.
Replicates	5		
		ontinued on next page .	

			ntinued from previous	page
Study Citation:	Will, L. A., I	Leininger, J. R., Donham, K. J. (1979). Regur	gitation and choke in ra	ts. Laboratory Animal Science 29(3):360-363.
Duration:		ation: > 21 days; Exposure Duration: > 21 da		•
Exposure Route,		Food/Diet; Dietary		
Media, Path:		•		
Taxa, Species, Age:	Vertebrate; N	Mammalian; Rattus norvegicus; F344 female;	Not Applicable (e.g., fu	ngi or algae studies) or Not Reported
Health Outcome:	Other (pleas	e specify below) (Choking)		
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)			
HERO ID:	3612470			
Domain		Metric	Rating	Comments
Domain 5: Outcome As	sessment			
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.
	Metric 18:	Consistency of Outcome	High	Outcomes were assessed consistently across study groups.
		Assessment		
Domain 6: Confounding	g / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test	Low	The study did not provide enough information to allow a comparison of environmental
		Design and Procedures		conditions.
	Metric 20:	Outcomes Unrelated to Exposure	Low	There were reported differences between male and female rats with no explanation as to
				why that might have occurred, regardless of what the feed contained.
Domain 7: Data Present	ation and Anal	vsis		
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group
	Metric 23:	Explanation of Unexpected Outcomes	Medium	Unexpected outcomes were satisfactorily explained, aside from the differences between
				male and female rats.
	D:00		1 (1 / 1)	
Additional Comments:				inclear the extent asbestos contributed to the choking played in the study
	outcomes, if	at all. Results of a mixture were also reported	1.	

Overall Quality Determination

Uninformative

Study Citation: Duration: Exposure Route,	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i> ; Adult ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167						
Domain		Metric	Rating	Comments			
Domain 1: Test Substand	се						
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.			
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.			
Domain 2: Test Design							
C	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.			
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.			
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.			
Domain 3: Exposure Ch	aracterization						
I	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.			
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 21 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.			
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.			
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 21 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.			
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.			
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.			
Domain 4: Test Organisi	m						
	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.			
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.			
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.			

Study Citation: Duration: Exposure Route, Media, Path:	Overall Duration: > 21 days; Exposure Duration: 11 - 21 days				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i> ; Adult ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167				
Domain		Metric	Rating	Comments	
Domain 5: Outcome As	ssessment				
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.	
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.	
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 21 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.	
Domain 6: Confounding	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."	
Domain 7: Data Presen	tation and Anal	ysis			
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.	
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.	
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily ex- plained. Variability was reported in Table 1 and in Figure 2.	
		Conti	nued on nex	xt page	

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nematodes); Lumbriculus rubellus; Adult						
Health Outcome:	ADME (biotransformation)						
Chemical:	asbestos (CASRN 1332-21-4)						
HERO ID:	3583167						
Domain	Metric	Rating	Comments				
Additional Comments:	was done on the accumulation of metals in non-exposure following that to give worms the worms for the 30 day exposure. Worm time to empty their guts prior to chemical exposed to soil with a pH of 5.0 and 5.7. T to bring soil to a pH of 5.0. Control sedim regarding the effect of the asbestos on the v or may not be due to asbestos. The overal the acidified asbestos-rich sediments and n most earthworms avoid salinity levels of 1.	a the worms for the 21 day exposure. Wo s time to empty their guts prior to chemic s were exposed to asbestos fibers for 30 analysis. The purpose of the study was to here were no asbestos-containing treatmo- ents were from Westham Island, while so worms, if it was due to the asbestos, the p l study score was ranked 'low' as a resu- nortality was particularly high in asbestos .4% (total dissolved salts) and 2.9% are c o 1.2, 2.1 and 2.2% in soils adjusted to pH	nesium ratio, Response Site: Not reported)This portion of the evaluation period of asbestos fibers for 21 days with a 5 day period cal analysis. This portion of the evaluation was done on the mortality days with a 5 day period of non-exposure following that to give wore test exposure of worms to asbestos fibers in soil. Control worms we ent groups that were exposed to a soil of pH 5.7 but citric acid was usediments were acidified with citric acid to 7.5. This creates uncertain pH soil, or both. It is clear pH alone has an effect on the worms that mIt. The study authors indicated "Survival rates dropped dramatically sediments acidified with H2SO4." "As shown by Piearce (1979, 1989; considered lethal. Tests after incubation showed that soil salinity might has a source of the so				

Overall Quality Determination

Low

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	се					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.		
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.		
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.		
Domain 3: Exposure Ch	aracterization					
Domain 5. Exposure on	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 21 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.		
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 21 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.		
Domain 4: Test Organis	m					
Zomani i. rost organisi	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.		

Domain 5: Outcome Assessment

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	 Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i>; Adult ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167 				
Domain		Metric	Rating	Comments	
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.	
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.	
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 21 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.	
Domain 6: Confounding	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."	
Domain 7: Data Presen	tation and Anal	vsis			
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.	
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.	
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily ex- plained. Variability was reported in Table 1 and in Figure 2.	
		Conti	nued on nex	t page	

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Overall Duration: > 21 days; Exposure Du	ration: 11 - 21 days authors (i.e., chemical of interest in expo	initic sediments. Soil Biology and Biochemistry 18(1):85-89.
Domain Additional Comments:	done on the accumulation of metals in the non-exposure following that to give worms the worms for the 30 day exposure. Worms time to empty their guts prior to chemical a exposed to soil with a pH of 5.0 and 5.7. Th to bring soil to a pH of 5.0. Control sedime regarding the effect of the asbestos on the w or may not be due to asbestos. The overall the acidified asbestos-rich sediments and m most earthworms avoid salinity levels of 1.4	worms for the 21 day exposure. Worr time to empty their guts prior to chemic swere exposed to asbestos fibers for 30 analysis. The purpose of the study was to here were no asbestos-containing treatment ents were from Westham Island, while sworms, if it was due to the asbestos, the p study score was ranked 'low' as a resu- nortality was particularly high in asbestos 4% (total dissolved salts) and 2.9% are of 1.2, 2.1 and 2.2% in soils adjusted to pH	Comments ntent, Response Site: Not reported)This portion of the evaluation wa ns were exposed to asbestos fibers for 21 days with a 5 day period of cal analysis.This portion of the evaluation was done on the mortality of days with a 5 day period of non-exposure following that to give worm to test exposure of worms to asbestos fibers in soil. Control worms were ent groups that were exposed to a soil of pH 5.7 but citric acid was use ediments were acidified with citric acid to 7.5. This creates uncertaint bH soil, or both. It is clear pH alone has an effect on the worms that ma It. The study authors indicated "Survival rates dropped dramatically is s sediments acidified with H2SO4." "As shown by Piearce (1979, 1982 considered lethal. Tests after incubation showed that soil salinity range H 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might hav

Overall Quality Determination

Low

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.		
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.		
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.		
Domain 3: Exposure Ch	aracterization					
2	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 21 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.		
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 21 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.		
Domain 4: Test Organis	n					
Zomani i. rost organisi	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.		

Domain 5: Outcome Assessment

Metric Adequacy of Test Conditions	Rating	
Adequacy of Test Conditions		Comments
	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.
Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 21 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.
rol		
Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
sis		
Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.
Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily explained. Variability was reported in Table 1 and in Figure 2.
	Explanation of Unexpected Outcomes	

Study Citation: Duration: Exposure Route,						
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:						
Domain	Metric	Rating	Comments			
Additional Comments:	the accumulation of metals in the worms for following that to give worms time to empty the 30 day exposure. Worms were exposed their guts prior to chemical analysis. The pri- with a pH of 5.0 and 5.7. There were no a to a pH of 5.0. Control sediments were fr the effect of the asbestos on the worms, it may not be due to asbestos. The overall st acidified asbestos-rich sediments and mor- most earthworms avoid salinity levels of 1.	or the 21 day exposure. Worms were exp y their guts prior to chemical analysis. T d to asbestos fibers for 30 days with a 5 urpose of the study was to test exposure asbestos-containing treatment groups tha rom Westham Island, while sediments w f it was due to the asbestos, the pH soi tudy score was ranked 'low' as a result. tality was particularly high in asbestos .4% (total dissolved salts) and 2.9% are to 1.2, 2.1 and 2.2% in soils adjusted to pl	Response Site: Not reported)This portion of the evaluation was done on posed to asbestos fibers for 21 days with a 5 day period of non-exposure his portion of the evaluation was done on the mortality of the worms for day period of non-exposure following that to give worms time to empty of worms to asbestos fibers in soil. Control worms were exposed to soil at were exposed to a soil of pH 5.7 but citric acid was used to bring soil vere acidified with citric acid to 7.5. This creates uncertainty regarding l, or both. It is clear pH alone has an effect on the worms that may or The study authors indicated "Survival rates dropped dramatically in the sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) considered lethal. Tests after incubation showed that soil salinity ranged H 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have			

Overall Quality Determination

Low

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biotransformation) asbestos (CASRN 1332-21-4) 3583167					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ce					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.		
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.		
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.		
Domain 3: Exposure Ch	aracterization					
2	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 21 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.		
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 21 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.		
Domain 4: Test Organis	n					
Zomani i. rost organisi	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.		

Domain 5: Outcome Assessment

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i> ; Adult ADME (biotransformation) asbestos (CASRN 1332-21-4)				
Domain	3583167	Metric	Rating	Comments	
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.	
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.	
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 21 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.	
Domain 6: Confoundin	g / Variable Co	ntrol			
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.	
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."	
Domain 7: Data Presen	tation and Anal	vsis			
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.	
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.	
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily explained. Variability was reported in Table 1 and in Figure 2.	
		Conti	inued on nex		

Study Citation: Duration:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days						
Exposure Route,	Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)						
Media, Path:							
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nema	atodes); Lumbriculus rubellus; Adult					
Health Outcome:	ADME (biotransformation)						
Chemical:	asbestos (CASRN 1332-21-4)						
HERO ID:	3583167						
Domain	Metric	Rating	Comments				
Additional Comments:	the accumulation of metals in the worms for following that to give worms time to empty the 30 day exposure. Worms were exposed their guts prior to chemical analysis. The pu- with a pH of 5.0 and 5.7. There were no a to a pH of 5.0. Control sediments were fr the effect of the asbestos on the worms, if may not be due to asbestos. The overall str acidified asbestos-rich sediments and mort most earthworms avoid salinity levels of 1.	or the 21 day exposure. Worms were exp y their guts prior to chemical analysis.Th d to asbestos fibers for 30 days with a 5 d urpose of the study was to test exposure usbestos-containing treatment groups tha form Westham Island, while sediments w f it was due to the asbestos, the pH soil udy score was ranked 'low' as a result.' tality was particularly high in asbestos s 4% (total dissolved salts) and 2.9% are co o 1.2, 2.1 and 2.2% in soils adjusted to pH	Response Site: Not reported)This portion of the evaluation was done of posed to asbestos fibers for 21 days with a 5 day period of non-exposu- his portion of the evaluation was done on the mortality of the worms fi day period of non-exposure following that to give worms time to emp of worms to asbestos fibers in soil. Control worms were exposed to so t were exposed to a soil of pH 5.7 but citric acid was used to bring so ere acidified with citric acid to 7.5. This creates uncertainty regardin , or both. It is clear pH alone has an effect on the worms that may The study authors indicated "Survival rates dropped dramatically in the sediments acidified with H2SO4." "As shown by Piearce (1979, 198 considered lethal. Tests after incubation showed that soil salinity range H 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might ha				

Overall Quality Determination

Low

Study Citation: Duration:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)				
Exposure Route,	Terrestrial; S	Soil; Not determined by study authors (i.e.,	, chemical of	interest in exposure water, but unable to determine exact uptake route)	
Media, Path: Taxa, Species, Age:	Invariabrata	; Worms (e.g., Annelids, Nematodes); Lum	horizulus mih	allerer A dult	
Health Outcome:	Mortality	, worms (e.g., Annends, iveniatodes), Lum	Uniculus rube	<i>mus</i> , Adun	
Chemical:	2	ASRN 1332-21-4)			
HERO ID:	3583167	1010(1002 21 1)			
Domain		Metric	Rating	Comments	
Domain 1: Test Substan	ice				
	Metric 1:	Test Substance Identity	Low	The test substance was simply identified as asbestos from serpentinitic rock and soil.	
	Metric 2:	Test Substance Source	Low	The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.	
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.	
Domain 2: Test Design					
U	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.	
	Metric 5:	Negative Control Response	High	The negative control response was reported in the text under "Results: Earthworm Survival." Results are also reported in figure 1. All earthworms survived in the negative control.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.	
Domain 3: Exposure Ch					
	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with H2SO4, but it was not stated how this was done. The test system was described adequately.	
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 21 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.	
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.	
	Metric 10:	Exposure Duration and Frequency	Medium	It was reported that no earthworms in the 21 and 30 day tests died in the unaltered as- bestos soil treatment. Perhaps the exposure duration could have been longer to see an effect at this level.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.	
Domain 4: Test Organis	m				
Johnani 4. Tost Organis	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.	
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the organisms were acclimatized.	
	Metric 15:	Number of Organisms and	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment.	

Study Citation: Duration: Exposure Route, Media, Path:	Overall Duration: > 21 days; Exposure Duration: 11 - 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Age: Invertebrate; Worms (e.g., Annelids, Nematodes); Lumbriculus rubellus; Adult me: Mortality asbestos (CASRN 1332-21-4)						
Taxa, Species, Age: Health Outcome: Chemical:							
HERO ID:	3583167						
Domain		Metric	Rating	Comments			
Domain 5: Outcome A	ssessment Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was mortality.			
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 21 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically.			
Domain 6: Confoundir	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmen- tal conditions. It was not reported whether the earthworms were acclimated to the test conditions. The authors indicated there may be an additional consequence with the ad- dition of citric acid and food. The study authors reported, "Survival in the sediments acidified with organic acids varied greatly. No worms survived in the sediments altered with acetic acid and (NH4)2SO4. In contrast, 81% survived in the sediments neutralized with citric acid. This was 10% higher than the survival in the unaltered asbestos sedi- ments and suggests that the addition of citric acid might have improved the conditions by adding additional food components."			
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acid used."			
Domain 7: Data Preser	tation and Anal	vsis					
	Metric 21:	Statistical Methods	Low	Only percent survival was reported for this section without a description of any statistical analysis performed.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest, which was mortality. Figure 1 contains data for all exposure related findings.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	Any variability in survival between replicates was not reported.			

Study Citation:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.					
Duration:	Overall Duration: > 21 days; Exposure Duration: 11 - 21 days					
Exposure Route,	Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Media, Path:						
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nematodes); Lumbriculus rubellus; Adult					
Health Outcome:	Mortality					
Chemical:	asbestos (CASRN 1332-21-4)					
HERO ID:	3583167					
Domain	Metric	Rating	Comments			
Additional Comments:	This portion of the evaluation was done on the mortality of the worms for the 21 day exposure. Worms were exposed to asbestos fibers for 21 days with					
	a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.7. There were no asbestos-containing treatment group that were exposed to a soil of pH 5.7. Control sediments were from Westham Island, while sediments were acidified with H2SO4 to a pH of 6. This create uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It's clear pH alone has an effect on the worms that may or may not be due to asbestos. The overall study score was ranked 'low' as a result. Although these results are for 21 days, the effects or soil pH cannot be ignored in the subsequent 30 day tests (both laboratory and field trials).					

Study Citation: Duration: Exposure Route, Media, Path:	 Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route) Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i>; Adult Mortality asbestos (CASRN 1332-21-4) 				
Taxa, Species, Age: Health Outcome: Chemical:					
HERO ID:	3583167				
Domain		Metric	Rating	Comments	
Domain 1: Test Substance					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.	
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.	
Domain 2: Test Design					
c	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.	
	Metric 5:	Negative Control Response	High	The negative control response was reported in the text under "Results: Earthworm Sur- vival." Results are also reported in figure 1. All earthworms survived in the negative control.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.	
Domain 3: Exposure Cha	aracterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various acids, but it was not stated how this was done. The test system was described adequately.	
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 30 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.	
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.	
	Metric 10:	Exposure Duration and Frequency	Medium	It was reported that no earthworms in the 21 and 30 day tests died in the unaltered as- bestos soil treatment. Perhaps the exposure duration could have been longer to see an effect at this level.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the chemical used to adjust the pH of the soil being tested.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.	
Domain 4: Test Organisr	n				
0	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.	
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the organisms were acclimatized.	
		Cont	inued on nex	t page	

Study Citation: Duration: Exposure Route, Modia Path	Overall Dura	ation: > 21 days; Exposure Duration: > 21	days	tos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. interest in exposure water, but unable to determine exact uptake route)
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mortality	Worms (e.g., Annelids, Nematodes); Lumb ASRN 1332-21-4)	priculus rub	ellus; Adult
Domain		Metric	Rating	Comments
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.
Domain 5: Outcome A	ssessment			
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was mortality.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 30 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically.
Domain 6: Confoundir	ng / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmen- tal conditions. It was not reported whether the earthworms were acclimated to the test conditions. The authors indicated there may be an additional consequence with the ad- dition of citric acid and food. The study authors reported, "Survival in the sediments acidified with organic acids varied greatly. No worms survived in the sediments altered with acetic acid and (NH4)2SO4. In contrast, 81% survived in the sediments neutralized with citric acid. This was 10% higher than the survival in the unaltered asbestos sedi- ments and suggests that the addition of citric acid might have improved the conditions by adding additional food components."
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acid used."
Domain 7: Data Preser	ntation and Anal	vsis		
	Metric 21:	Statistical Methods	Low	Only percent survival was reported for this section without a description of any statistical analysis performed.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest, which was mortality. Figure 1 contains data for all exposure related findings.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Any variability in survival between replicates was not reported.

Study Citation: Duration:		· ·				
	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,		-	sure water, but unable to determine exact uptake route)			
Aedia, Path:						
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemat	todes); Lumbriculus rubellus; Adult				
Health Outcome:	Mortality					
Chemical:	asbestos (CASRN 1332-21-4)					
IERO ID:	3583167					
Domain	Metric	Rating	Comments			
Additional Comments:	day period of non-exposure following that to of worms to asbestos fibers in soil. Control were exposed to a soil of pH 5.7 but citric a acidified with citric acid to 7.5. This creates It is clear pH alone has an effect on the wor authors indicated "Survival rates dropped of acidified with H2SO4." "As shown by Piea	to give worms time to empty their guts p worms were exposed to soil with a pH of acid was used to bring soil to a pH of 5.0 s uncertainty regarding the effect of the a orms that may or may not be due to asb dramatically in the acidified asbestos-ric urce (1979, 1982) most earthworms avoid oil salinity ranged from 0.02% in the unit	v exposure. Worms were exposed to asbestos fibers for 30 days v rior to chemical analysis. The purpose of the study was to test ex of 5.0 and 5.7. There were no asbestos-containing treatment grou). Control sediments were from Westham Island, while sedimen sbestos on the worms, if it was due to the asbestos, the pH soil, o estos. The overall study score was ranked 'low' as a result. Th h sediments and mortality was particularly high in asbestos sed a salinity levels of 1.4% (total dissolved salts) and 2.9% are con acidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH gh mortality rate in the first experiment"	exposure oups that nts were or both he study cdiment nsideree		

Worms (e.g., Annelids, Nematodes); <i>Lun</i> ASRN 1332-21-4) <u>Metric</u> Test Substance Identity Test Substance Source		interest in exposure water, but unable to determine exact uptake route) ellus; Adult Comments
ASRN 1332-21-4) Metric Test Substance Identity Test Substance Source		
Metric Test Substance Identity Test Substance Source	Rating	Comments
Metric Test Substance Identity Test Substance Source	Rating	Comments
Test Substance Identity Test Substance Source	Rating	Comments
Test Substance Source		
Test Substance Source		
	Low	The test substance was simply identified as asbestos from serpentinitic rock and soil.
	Low	The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.
Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.
Negative Controls	High	Study authors reported using Westham Island soil as a negative control.
Negative Control Response	Low	The negative control response was reported in the text under "Results: Earthworm Survival." Results are also reported in figure 1. Only 15% of the control worms survived the 297 day study.
Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Experimental System/Test Madia	Low	Tast madie was said to have been altered to adjust the all with USOA but it was not
Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with H2SO4, but it was not stated how this was done. The test system was described adequately.
Consistency of Exposure	High	Details of exposure administration were reported and exposures were administered con-
Administration	8	sistently across study groups. All exposures were for 297 days in 25L plastic containers that were watered 3 times during dry periods. This portion of the test is referred to as the "field study" by the study authors.
Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.
Exposure Duration and Frequency	Medium	It was reported that earthworms in both asbestos exposures died before the end of the 297 day study. Perhaps a shorter exposure duration would have been suitable to obtain more data on survival and reproduction.
Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested
Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.
Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.
Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.
Conditions Number of Organisms and	Low	There were 20 earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.
]	Fest Organism Characteristics Acclimatization and Pretreatment Conditions Number of Organisms and Replicates per Group	Fest Organism Characteristics Medium Acclimatization and Pretreatment Low Conditions Number of Organisms and Low

Study Citation: Duration: Exposure Route, Media, Path:	Overall Dura	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Mortality	Worms (e.g., Annelids, Nematodes); <i>Lum</i> ASRN 1332-21-4)	briculus rube	ellus; Adult			
Domain		Metric	Rating	Comments			
Domain 5: Outcome A	ssessment Metric 16:	Adequacy of Test Conditions	Medium	This portion of the study was conducted outdoors, and environmental conditions were not reported. Worms were fed clover straw during the study and loading rate seemed appropriate.			
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was mortality.			
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 297 days, the worms were assessed for survival and reproduction.			
Domain 6: Confoundir	g / Variable Co	ntrol					
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmen- tal conditions. It was not reported whether the earthworms were acclimated to the test conditions. The authors indicated there may be an additional consequence with the ad- dition of citric acid and food. The study authors reported, "Survival in the sediments acidified with organic acids varied greatly. No worms survived in the sediments altered with acetic acid and (NH4)2SO4. In contrast, 81% survived in the sediments neutralized with citric acid. This was 10% higher than the survival in the unaltered asbestos sedi- ments and suggests that the addition of citric acid might have improved the conditions by adding additional food components."			
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acid used."			
Domain 7: Data Preser	ntation and Anal	ysis					
	Metric 21:	Statistical Methods	Low	Only percent survival was reported for this section without a description of any statistical analysis performed.			
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group and were adequate to determine values for the endpoint of interest, which was mortality. Figure 1 contains data for all exposure related findings.			
	Metric 23:	Explanation of Unexpected Outcomes	Low	Any variability in survival between replicates was not reported.			

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Study Citation:	Schreier, H., Timmenga, H. J. (1986). Earthy	worm response to asbestos rich serpe	entinitic sediments. Soil Biology and Biochemistry 18(1):85-89.
Duration:	Overall Duration: > 21 days; Exposure Dura	ation: > 21 days	
Exposure Route,	Terrestrial; Soil; Not determined by study au	uthors (i.e., chemical of interest in ex	posure water, but unable to determine exact uptake route)
Media, Path:			
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemato	odes); Lumbriculus rubellus; Adult	
Health Outcome:	Mortality		
Chemical:	asbestos (CASRN 1332-21-4)		
HERO ID:	3583167		
Domain	Metric	Rating	Comments
Additional Comments:	This portion of the evaluation was done on t	he mortality of the worms for the 29°	7 day exposure. Worms were exposed to asbestos fibers for 297 days after
	which they were assessed for survival and r	reproduction. This portion of the eval	luation was done on the mortality of the worms for the 30 day exposure.
	Worms were exposed to asbestos fibers for	30 days with a 5 day period of non	-exposure following that to give worms time to empty their guts prior to
	chemical analysis. The purpose of the study	was to test exposure of worms to asb	bestos fibers in soil. Control worms were exposed to soil with a pH of 5.7.
	There were no asbestos-containing treatmen	t groups that were exposed to a soil	of pH 5.7. This creates uncertainty regarding the effect of the asbestos on
	the worms, if it was due to the asbestos, the	pH soil, or both. It is clear pH alone	e has an effect on the worms that may or may not be due to asbestos. The
	overall study score was ranked 'low' as a res	sult	

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)			
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biot	Worms (e.g., Annelids, Nematodes); <i>Lum</i> ransformation) ASRN 1332-21-4)	ıbriculus rube	llus; Adult
Domain		Metric	Rating	Comments
Domain 1: Test Substand	ce			
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.
Domain 2: Test Design				
C	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Ch	aracterization			
I I I I I I I I I I I I I I I I I I I	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 30 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 30 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.
Domain 4: Test Organisi	m			
	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical:	Overall Dura Terrestrial; S Invertebrate; ADME (biot	ation: > 21 days; Exposure Duration: > 21	days chemical of	tos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. interest in exposure water, but unable to determine exact uptake route) ellus; Adult
HERO ID:	3583167			
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 30 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.
Domain 6: Confoundir	ng / Variable Con	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
Domain 7: Data Preser	ntation and Anal	vsis		
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily explained. Variability was reported in Table 1 and in Figure 2.

Additional Comments: 30 day duration. Biochemical (Biochemistry-Chromium content, Response Site: Not reported)This portion of the evaluation was done on the accumulation of metals in the worms for the 30 day exposure. Worms were exposed to asbestos fibers for 30 days with a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.0 and 5.7. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5.7 but citric acid was used to bring soil to a pH of 5.0. Control sediments were from Westham Island, while sediments were acidified with citric acid to 7.5. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It is clear pH alone has an effect on the worms that may or may not be due to asbestos-rich sediments and mortality was particularly high in asbestos sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) most earthworms avoid salinity levels of 1.4% (total dissolved salts) and 2.9% are considered lethal. Tests after incubation showed that soil salinity ranged from 0.02% in the unacidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have contributed to the high mortality rate in the first experiment."

		continued from previous page	
Study Citation:	Schreier, H., Timmenga, H. J. (1986). Earth	worm response to asbestos rich serpentinit	tic sediments. Soil Biology and Biochemistry 18(1):85-89.
Duration:	Overall Duration: > 21 days; Exposure Dur	ration: > 21 days	
Exposure Route,		-	re water, but unable to determine exact uptake route)
Media, Path:		· · · · · ·	
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemato	odes); Lumbriculus rubellus; Adult	
Health Outcome:	ADME (biotransformation)		
Chemical:	asbestos (CASRN 1332-21-4)		
HERO ID:	3583167		
Domain	Metric	Rating	Comments

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)					
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biot	Worms (e.g., Annelids, Nematodes); <i>Lun</i> transformation) ASRN 1332-21-4)	ıbriculus rube	<i>illus</i> ; Adult		
Domain		Metric	Rating	Comments		
Domain 1: Test Substand	ce					
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.		
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.		
Domain 2: Test Design						
C	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.		
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.		
Domain 3: Exposure Ch	aracterization					
I	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 30 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.		
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 30 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.		
Domain 4: Test Organis	n					
	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.		
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.		
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.		

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome:	 Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake rou Age: Invertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i>; Adult 			interest in exposure water, but unable to determine exact uptake route)
Chemical: HERO ID:	asbestos (CA 3583167	ASRN 1332-21-4)		
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 30 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.
Domain 6: Confoundir	ng / Variable Con	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
Domain 7: Data Preser	ntation and Anal	vsis		
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily ex- plained. Variability was reported in Table 1 and in Figure 2.

Additional Comments: 30 day duration. Biochemical (Biochemistry-Calcium to magnesium ratio, Response Site: Not reported)This portion of the evaluation was done on the accumulation of metals in the worms for the 30 day exposure. Worms were exposed to asbestos fibers for 30 days with a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.0 and 5.7. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5.7 but citric acid was used to bring soil to a pH of 5.0. Control sediments were from Westham Island, while sediments were acidified with citric acid to 7.5. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It is clear pH alone has an effect on the worms that may or may not be due to asbestos-rich sediments and mortality was particularly high in asbestos sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) most earthworms avoid salinity levels of 1.4% (total dissolved salts) and 2.9% are considered lethal. Tests after incubation showed that soil salinity ranged from 0.02% in the unacidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have contributed to the high mortality rate in the first experiment."

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Study Citation:		1 1	tic sediments. Soil Biology and Biochemistry 18(1):85-89.
Duration:	Overall Duration: > 21 days; Exposure Dur	ation: > 21 days	
Exposure Route,	Terrestrial; Soil; Not determined by study an	uthors (i.e., chemical of interest in exposur	e water, but unable to determine exact uptake route)
Media, Path:			
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemate	odes); Lumbriculus rubellus; Adult	
Health Outcome:	ADME (biotransformation)		
Chemical:	asbestos (CASRN 1332-21-4)		
HERO ID:	3583167		
Domain	Metric	Rating	Comments

Study Citation: Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days					
Exposure Route,	Terrestrial; S	Soil; Not determined by study authors (i.e.	, chemical of	interest in exposure water, but unable to determine exact uptake route)		
Media, Path:						
Taxa, Species, Age:		; Worms (e.g., Annelids, Nematodes); Lun	ıbriculus rube	<i>llus</i> ; Adult		
Health Outcome:		e/Teratogenic				
Chemical:		ASRN 1332-21-4)				
HERO ID:	3583167					
Domain		Metric	Rating	Comments		
Domain 1: Test Substan	ice					
	Metric 1:	Test Substance Identity	Low	The test substance was simply identified as asbestos from serpentinitic rock and soil.		
	Metric 2:	Test Substance Source	Low	The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.		
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.		
Domain 2: Test Design						
	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.		
	Metric 5:	Negative Control Response	Low	The negative control response was reported in the text under "Results: Earthworm Survival." It was reported that only 15% of the control worms went on to reproduce.		
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.		
Domain 3: Exposure Ch			_			
	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with H2SO4, but it was not stated how this was done. The test system was described adequately.		
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered con- sistently across study groups. All exposures were for 297 days in 25L plastic containers that were watered 3 times during dry periods. This portion of the test is referred to as the "field study" by the study authors.		
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.		
	Metric 10:	Exposure Duration and Frequency	Medium	It was reported that earthworms in both asbestos exposures died before the end of the 297 day study. Perhaps a shorter exposure duration would have been suitable to obtain more data on survival and reproduction.		
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested		
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.		
Domain 4: Test Organis	.m					
en e	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.		
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the organisms were acclimatized.		
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were 20 earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.		

Study Citation: Duration:		, Timmenga, H. J. (1986). Earthworm respo ation: > 21 days; Exposure Duration: > 21		tos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.
Exposure Route,				interest in exposure water, but unable to determine exact uptake route)
Media, Path:				
Taxa, Species, Age: Health Outcome:		; Worms (e.g., Annelids, Nematodes); <i>Luml</i> e/Teratogenic	briculus rube	<i>ellus</i> ; Adult
Chemical:		ASRN 1332-21-4)		
HERO ID:	3583167			
Domain		Metric	Rating	Comments
Domain 5: Outcome Ass	sessment			
	Metric 16:	Adequacy of Test Conditions	Medium	This portion of the study was conducted outdoors, and the environmental conditions were not reported. Worms were fed clover straw during the study and loading rate seemed appropriate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was reproduction.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 297 days, the worms were assessed for survival and reproduction.
Domain 6: Confounding	g / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
Domain 7: Data Presenta	ation and Anal	lysis		
	Metric 21:	Statistical Methods	Low	Only percent reproduction was reported for this section without a description of any statistical analysis performed.
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for each treatment and control group. Reproduction could not be assessed for the asbestos treatments because all the worms in those treatments died before the end of the 297 day study.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Any variability in survival between replicates was not reported.
Additional Comments:	This portion of the evaluation was done on the reproduction of the worms for the 297 day exposure. Worms were exposed to asbestos fibers for 297 day after which they were assessed for survival and reproduction. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Contr worms were exposed to soil with a pH of 5. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5 over the course of the study. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. The overall study sco was ranked 'low' as a result.			purpose of the study was to test exposure of worms to asbestos fibers in soil. Control -containing treatment groups that were exposed to a soil of pH 5 over the course of the
Overall Qualit	y Deterr	nination	Low	

Study Citation: Duration: Exposure Route, Madia Batha	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)				
Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biot	brate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i> ; Adult E (biotransformation) os (CASRN 1332-21-4) 57			
Domain		Metric	Rating	Comments	
Domain 1: Test Substan	ce				
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.	
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.	
Domain 2: Test Design					
6	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.	
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.	
Domain 3: Exposure Ch	aracterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.	
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 30 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.	
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.	
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 30 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.	
Domain 4: Test Organis	m				
	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.	
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.	
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.	

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Overall Dura Terrestrial; S Invertebrate; ADME (biot	ation: > 21 days; Exposure Duration: > 21	days chemical of	tos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. interest in exposure water, but unable to determine exact uptake route) <i>ellus</i> ; Adult
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 30 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.
Domain 6: Confoundir	ng / Variable Co	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
Domain 7: Data Preser	ntation and Anal	ysis		
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily ex- plained. Variability was reported in Table 1 and in Figure 2.

Additional Comments: Exposure duration 30 days. Biochemical (Biochemistry-Nickel content, Response Site: Not reported)This portion of the evaluation was done on the accumulation of metals in the worms for the 30 day exposure. Worms were exposed to asbestos fibers for 30 days with a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.0 and 5.7. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5.7 but citric acid was used to bring soil to a pH of 5.0. Control sediments were from Westham Island, while sediments were acidified with citric acid to 7.5. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It is clear pH alone has an effect on the worms that may or may not be due to asbestos. The overall study score was ranked 'low' as a result. The study authors indicated "Survival rates dropped dramatically in the acidified asbestos-rich sediments and mortality was particularly high in asbestos sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) most earthworms avoid salinity levels of 1.4% (total dissolved salts) and 2.9% are considered lethal. Tests after incubation showed that soil salinity ranged from 0.02% in the unacidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have contributed to the high mortality rate in the first experiment."

		continued from previous page		
Study Citation:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.			
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days			
Exposure Route,	Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:		-	-	
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemato	odes); Lumbriculus rubellus; Adult		
Health Outcome:	ADME (biotransformation)			
Chemical:	asbestos (CASRN 1332-21-4)			
HERO ID:	3583167			
Domain	Metric	Rating	Comments	

Study Citation: Duration: Exposure Route, Media, Path:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. Overall Duration: > 21 days; Exposure Duration: > 21 days Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)				
Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	ADME (biot	nvertebrate; Worms (e.g., Annelids, Nematodes); <i>Lumbriculus rubellus</i> ; Adult ADME (biotransformation) sbestos (CASRN 1332-21-4) 583167			
Domain		Metric	Rating	Comments	
Domain 1: Test Substan	ce				
	Metric 1: Metric 2:	Test Substance Identity Test Substance Source	Low Low	The test substance was simply identified as asbestos from serpentinitic rock and soil. The test substance was from a 1975 flood deposit in Whatcom Country, Washington. The study authors did not report if it was analytically verified.	
	Metric 3:	Test Substance Purity	Low	The purity of the test substance was not reported. There was not report of what the as- bestos was made of in terms of metals.	
Domain 2: Test Design					
C	Metric 4:	Negative Controls	High	Study authors reported using Westham Island soil as a negative control.	
	Metric 5:	Negative Control Response	High	The negative control response was reported in Table 1 and in Figure 2, and was ade- quate.	
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.	
Domain 3: Exposure Ch	aracterization				
1	Metric 7:	Experimental System/Test Media Preparation	Low	Test media was said to have been altered to adjust the pH with various chemicals, but it was not stated how this was done. The test system was described adequately.	
	Metric 8:	Consistency of Exposure Administration	High	Details of exposure administration were reported and exposures were administered consistently across study groups. All exposures were for 30 days with a 5 day non-exposure period for worms to empty their guts. Exposures were in the dark at 10C.	
	Metric 9:	Measurement of Test Substance Concentration	Low	The study authors did not report whether the asbestos was measured during the test or before the test.	
	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 30 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.	
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is insoluble and the exposure was via soil.	
Domain 4: Test Organis	n				
it isso organis	Metric 13:	Test Organism Characteristics	Medium	The organisms were reported to be collected from a clover field near Vancouver. This creates questions regarding organism health.	
	Metric 14:	Acclimatization and Pretreatment	Low	The study authors did not report whether the organisms were acclimatized.	
	Metric 15:	Conditions Number of Organisms and Replicates per Group	Low	There were 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.	

Study Citation: Duration: Exposure Route, Media, Path: Taxa, Species, Age: Health Outcome: Chemical: HERO ID:	Overall Dura Terrestrial; S Invertebrate; ADME (biot	ation: > 21 days; Exposure Duration: > 21	days chemical of	tos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89. interest in exposure water, but unable to determine exact uptake route) <i>ellus</i> ; Adult
Domain		Metric	Rating	Comments
	Metric 16:	Adequacy of Test Conditions	High	Earthworms were kept in the dark at 10C for the duration of the test. Worms were fed clover straw during the study.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology addressed or reported the intended outcome of interest, which was accumulation of metals due to asbestos exposure.
	Metric 18:	Consistency of Outcome Assessment	High	Details of the outcome assessment protocol were reported, and outcomes were assessed consistently across study groups. After 30 days, the worms were removed from the test substance and placed in petri dishes with wet filter paper for 5 days to empty their guts. They were then analyzed chemically for metal accumulation.
Domain 6: Confoundir	ng / Variable Con	ntrol		
	Metric 19:	Confounding Variables in Test Design and Procedures	Low	The study did not provide enough information to allow a comparison of environmental conditions. It was not reported whether the earthworms were acclimated to the test conditions.
	Metric 20:	Outcomes Unrelated to Exposure	High	The study authors reported "Acidification of asbestos decreased survival rate substan- tially, but this is dependent on the acidused."
Domain 7: Data Preser	ntation and Anal	vsis		
	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
	Metric 22:	Reporting of Data	Medium	Data for exposure-related findings were presented for most treatments and the control group and were adequate to determine values for the endpoint of interest, which was accumulation of metals. The study did not report results for all the asbestos treatments and their pHs.
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes, or unexpected outcomes were satisfactorily explained. Variability was reported in Table 1 and in Figure 2.

Additional Comments: 30 day duration. Biochemical (Biochemistry-Magnesium (Mg) content, Response Site: Not reported)This portion of the evaluation was done on the accumulation of metals in the worms for the 30 day exposure. Worms were exposed to asbestos fibers for 30 days with a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis. The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.0 and 5.7. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5.7 but citric acid was used to bring soil to a pH of 5.0. Control sediments were from Westham Island, while sediments were acidified with citric acid to 7.5. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It is clear pH alone has an effect on the worms that may or may not be due to asbestos-rich sediments and mortality was particularly high in asbestos sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) most earthworms avoid salinity levels of 1.4% (total dissolved salts) and 2.9% are considered lethal. Tests after incubation showed that soil salinity ranged from 0.02% in the unacidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have contributed to the high mortality rate in the first experiment."

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days			
Exposure Route,	Terrestrial; Soil; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)			
Media, Path:		-	-	
Taxa, Species, Age:	Invertebrate; Worms (e.g., Annelids, Nemato	odes); Lumbriculus rubellus; Adult		
Health Outcome:	ADME (biotransformation)			
Chemical:	asbestos (CASRN 1332-21-4)			
HERO ID:	3583167			
Domain	Metric	Rating	Comments	

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	Metric 10:	Exposure Duration and Frequency	Medium	The exposure duration of 30 days was appropriate for the outcomes of interest. Re- searchers were able to see an increase in accumulation of Ni and Mg components.	
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	There was only one exposure concentration of the asbestos. What changed was the pH of the soil being tested.	
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Chemical: HERO ID:	asbestos (CA 3583167	ASRN 1332-21-4)		
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Additional Comments: 297 day duration. Biochemical (Biochemistry-Calcium content,Chromium content,Magnesium (Mg) content,Nickel content, Response Site: Feces)This portion of the evaluation was done on the accumulation of metals in the worms for the 30 day exposure. Worms were exposed to asbestos fibers for 30 days with a 5 day period of non-exposure following that to give worms time to empty their guts prior to chemical analysis.The purpose of the study was to test exposure of worms to asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.0 and 5.7. There were no asbestos-containing treatment groups that were exposed to a soil of pH 5.7 but citric acid was used to bring soil to a pH of 5.0. Control sediments were from Westham Island, while sediments were acidified with citric acid to 7.5. This creates uncertainty regarding the effect of the asbestos on the worms, if it was due to the asbestos, the pH soil, or both. It is clear pH alone has an effect on the worms that may or may not be due to asbestos. The overall study score was ranked 'low' as a result. The study authors indicated "Survival rates dropped dramatically in the acidified asbestos-rich sediments and mortality was particularly high in asbestos sediments acidified with H2SO4." "As shown by Piearce (1979, 1982) most earthworms avoid salinity levels of 1.4% (total dissolved salts) and 2.9% are considered lethal. Tests after incubation showed that soil salinity ranged from 0.02% in the unacidified sediments to 1.2, 2.1 and 2.2% in soils adjusted to pH 8.3, 7.1 and 5.3, respectively. It is thus evident that salinity might have contributed to the high mortality rate in the first experiment."

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Health Outcome:	ADME (biotransformation)			
Chemical:	asbestos (CASRN 1332-21-4)			
HERO ID:	3583167			
Domain	Metric	Rating	Comments	