United States
Environmental Protection Agency

November 2024
Office of Chemical Safety and
Pollution Prevention

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

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, 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; *Lepomis cyanellus*; Juvenile
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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				
	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 Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	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 address the purpose of the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 Conditions	High	The test organisms were acclimatized.
	Metric 15:	Number of Organisms and Replicates per Group	Low	Replicates were not reported.
Domain 5: Outcome Assessment				

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Lepomis cyanellus*; Juvenile
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (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 adequate.
	Metric 17:	Outcome Assessment Methodology	High	Mortalities were checked twice a day.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination 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 pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Lepomis cyanellus*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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				
	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 Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	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 Organism				
	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 Conditions	High	The test organisms were acclimatized.
	Metric 15:	Number of Organisms and Replicates per Group	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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Taxa, Species, Age:	Vertebrate; Fish; *Lepomis cyanellus*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain	Metric		Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	Mortalities were checked twice a day.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	It was not clear if statistical analysis was performed, but raw data was reported.
	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 Quality Determination 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, 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*; Embryo
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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	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.
Domain 3: Exposure Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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Exposure 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*; Embryo
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 were no differences among groups, but few details were provided.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination 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.
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Exposure 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*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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	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 3: Exposure Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	High	The response to the TMS treatment was assessed.

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination 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, 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*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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	There was high control mortality of 19%.
	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 Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	High	Mortalities were checked twice a day.

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Exposure 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*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination 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, 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:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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	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 Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (40 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	Not all fish were examined.

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Exposure 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:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology
Chemical:	chrysotile (serpentine) (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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Low

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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 Substance				
	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	There was a high control mortality of 19%. The assessed response was not clearly reported.
	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 Preparation	Medium	The study provided only limited details on the measures taken to appropriately prepare test concentrations (used sonification).
	Metric 8:	Consistency of Exposure Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (86 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	Not all fish were examined.

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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 and pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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*; Embryo
Health Outcome:	Mechanistic-Cancer/Carcinogenesis-Developmental and juvenile toxicology
Chemical:	chrysotile (serpentine) (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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Low

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, 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:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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 Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	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 Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	High	Mortalities were checked twice a day.

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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 and pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination 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, 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

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	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%. 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 Characterization				
	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 Administration	High	Exposures were administered consistently across study groups in a static situation.
	Metric 9:	Measurement of Test Substance Concentration	Low	Measurements were not reported.
	Metric 10:	Exposure Duration and Frequency	Low	Study authors reported a long duration (40 days).
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	Replicates were not reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Low	The outcome assessment methodology was not clearly reported.

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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 and pathological stress. Environmental Research 39(1):74-85.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584231

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Medium	Outcomes were assessed consistently across study groups, but few details were provided.
Domain 6: Confounding / Variable Control				
	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 were no differences among groups, but few details were provided.
Domain 7: Data Presentation and Analysis				
	Metric 21:	Statistical Methods	Uninformative	Statistical analysis was not conducted.
	Metric 22:	Reporting of Data	Low	The results were not completely reported.
	Metric 23:	Explanation of Unexpected Outcomes	Medium	No unexpected outcomes were reported.

Additional Comments: None

Overall Quality Determination Uninformative

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (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 Characterization				
	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/ 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 Organism				
	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 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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (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 Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (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 Characterization				
	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/ 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 Organism				
	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 they were not explicitly stated.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were only 10 organisms with no replicates used.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (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 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 Characterization				
	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/ 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 Organism				
	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	Low	There were10 organisms per treatment group.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (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 Characterization				
	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/ 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 Organism				
	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 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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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; *Oryzias latipes*; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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, 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; *Oryzias latipes*; Larvae
Health Outcome:	Mechanistic-Liver toxicology
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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	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/ 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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Larvae
Health Outcome:	Mechanistic-Liver toxicology
Chemical:	chrysotile (serpentine) (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.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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:	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, 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; *Oryzias latipes*; Larvae
Health Outcome:	Mechanistic-Kidney/renal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ Spacing of Exposure Levels	High	The number of exposure groups and spacing of exposure levels were justified for a dose response the by study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 were unclear; 15 organisms per treatment were used.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test 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.

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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, 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; *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 / Variable Control				
	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 Presentation and Analysis				
	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:	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, 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; *Oryzias latipes*; Larvae
Health Outcome:	Mechanistic-Gastrointestinal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	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 were unclear; 15 organisms per treatment were used.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the 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.

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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, 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; *Oryzias latipes*; Larvae
Health Outcome:	Mechanistic-Gastrointestinal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 goblet cells.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Larvae
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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.
	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 Characterization				
	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 measured, but the methods used were not clear.
	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	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Larvae
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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 Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This part of the study focused on pathology findings. Body burden was reported but not 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 Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Larvae
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (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.
	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 Characterization				
	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 measured, but the methods used were not clear.
	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	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the 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	Mortalities were checked daily.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Larvae
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (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.
	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 reported to be somewhat low.
	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 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/ Spacing of Exposure Levels	Medium	Only two exposure groups were used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 four replicates used in breeding tanks.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (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.
	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 reported to be somewhat low.
	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 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/ Spacing of Exposure Levels	Medium	Only two exposure groups were used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 four replicates used in breeding tanks.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (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.
	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 reported to be somewhat low.
	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 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/ Spacing of Exposure Levels	Medium	Only two exposure groups were used.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 four replicates used in breeding tanks.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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). Functional and pathological impairment of japanese medaka (Oryzias latipes) by long-term asbestos exposure. Aquatic Toxicology 17(2):133-154.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Oryzias latipes*; Juvenile
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3585046

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Mortalities were checked daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Overall Quality Determination High

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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 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 study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	It was not reported if the organisms were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates and 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.

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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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 not reported, other than mention that there was no acute effects.
	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 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 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 study author.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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	Low	It was not reported if the organisms were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates and 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (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.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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, 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; *Pimephales promelas*; Adult
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	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	Low	It was not reported if the organisms were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates and 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (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, 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; *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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	Statistical analysis 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	Unexpected outcomes were not satisfactorily explained.

Additional Comments: This was an accumulation study.

Overall Quality Determination Medium

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, 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; *Pimephales promelas*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 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				
	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	Low	It was not reported if the organisms were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates and 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (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, 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; *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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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, 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 Characterization				
	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 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.

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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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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, 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; *Pimephales promelas*; Adult
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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, 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 Characterization				
	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 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 performance.

Overall Quality Determination High

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, 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; *Pimephales promelas*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the 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.

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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, 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; *Pimephales promelas*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 10 organisms per replicate.
Domain 5: Outcome Assessment				
	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.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.

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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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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, 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; *Pimephales promelas*; Adult
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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, 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 Characterization				
	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 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	The were two replicates with 10 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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, 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; *Pimephales promelas*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 mortality.
	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 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/ 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 15 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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. (1985). Functional and pathological responses of selected aquatic organisms to chrysotile asbestos.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Uninformative

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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 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				
	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 fish were acclimatized to lab conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Low	There were two replicates with 15 organisms per replicate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the 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.

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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, 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; *Pimephales promelas*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	4350438

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination 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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Hepatic/Liver
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3582159

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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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. Environment International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination 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 International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Renal/Kidney
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3582159

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.

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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. Environment International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Renal/Kidney
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3582159

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination 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 International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; 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
Domain 1: Test Substance				
	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 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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.

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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. Environment International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; 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 Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination 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 International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cardiovascular
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3582159

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.

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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. Environment International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cardiovascular
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3582159

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination 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 International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; 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
Domain 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology partially addressed the intended outcomes, but few details were provided.

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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. Environment International 9(3):173-176.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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; *Poecilia formosa*; 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 Assessment	Low	Details regarding the execution of the study protocol for the outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: None

Overall Quality Determination Low

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, 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 fluminea*; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 3: Exposure Characterization				
	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	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 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 included in the study.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 7 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, 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 Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Mortality
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 organism 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	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 confusing, limited, or not reported.
Domain 6: Confounding / Variable Control				
	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 control. 2/120 and 3/60 clams died at the highest exposure level for summer-collected and winter-collected clams, respectively.
Domain 7: Data Presentation and Analysis				
	Metric 21:	Statistical Methods	N/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 applies to both summer-collected and winter-collected clams.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Respiratory
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 7 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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 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 / Variable Control				
	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 Presentation and Analysis				
	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 sampled 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 applies to the gill locules of summer-collected and winter-collected clams.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 (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: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment 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. It was stated in methods that clams were grouped by 10 without mention of replicates.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 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 / Variable Control				
	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 Presentation and Analysis				
	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 apples to the shell growth of winter-collected and summer-collected clams.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 (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 Characterization				
	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 content).
	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 Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment 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 Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Development/Growth
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 organism 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 adequately described.
	Metric 18:	Consistency of Outcome Assessment	Medium	It was unclear how often measurements were taken.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 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 applies to weights and tissue water in winter-collected and summer-collected clams.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	It was not stated what solvent type was used for the 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	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 Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized 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 Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 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 organism 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 Control				
	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 Presentation and Analysis				
	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 applies to the siphoning activity of summer and winter-collected clams.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 fluminea*; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093856

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 endpoint (fiber burdens).
	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 Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 7 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	N was reported in Table 2 as 2-4, and three clams were utilized for Table 3 data.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health. Measurements of pH, ammonia, alkalinity, hardness, and nutrient content were analyzed on days 0 and 30 of the experiment. Temperature was measured.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 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 Assessment	High	The outcome was determined at the conclusion of the study.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: This form applies to the accumulation of fibers in the gills and viscera in both summer-collected and winter-collected clams.

Overall Quality Determination Low

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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized 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.
Domain 5: Outcome Assessment				

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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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Behavioral
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 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 / Variable Control				
	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 Presentation and Analysis				
	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 fed organisms.

Overall Quality Determination High

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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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 Organism				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 control.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.

Additional Comments: This portion of the study assessed accumulation in the gills and viscera of organisms that were fed.

Overall Quality Determination High

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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	No statistical analysis was performed because no mortality was reported. 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: This form assessed organisms that were fed and not fed.

Overall Quality Determination High

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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 was on the accumulation of asbestos in the gills and viscera in organisms that were not fed.

Overall Quality Determination High

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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized 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.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 organisms that were not fed.

Overall Quality Determination High

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Assessment				

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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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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:	Mortality
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 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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Low	No biological replicates were reported.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure 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:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 mortality.

Overall Quality Determination High

Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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.*; species was not specified in this paper; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584230

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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Few details were provided on the experimental system, but the exposure concentrations were measured.
	Metric 8:	Consistency of Exposure Administration	High	There was no mention of irregularities in exposure 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/ Spacing of Exposure Levels	Medium	There were only 2 exposure groups in the laboratory setting.
	Metric 12:	Testing at or Below Solubility Limit	N/A	This was an asbestos exposure with possible dietary exposure.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Low	Just the genus and not the species was given. Laboratory test organisms were field collected from the New River, VA.
	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 Replicates per Group	Medium	The numbers of test organisms and replicates were reported and sufficient to characterize toxicological effects.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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.*; species was not specified in this paper; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Development/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 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 / Variable Control				
	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 Presentation and Analysis				
	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 shell size and tissue water.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Respiratory
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Respiratory
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 composition.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 whole body, gills, and viscera. BCFs were also calculated.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Skin and Connective Tissue
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Skin and Connective Tissue
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 siphoning behavior.

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Skin and Connective Tissue
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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/ 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				
	Metric 13:	Test Organism Characteristics	Medium	There are minor reservations about the source (wild caught) of the test organisms.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	The test organisms were acclimatized to test conditions for 14 days.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	No biological replicates were reported, but the experiment was repeated 5 times.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	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., 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure 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:	Skin and Connective Tissue
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3093600

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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, but results were described in the text.
	Metric 23:	Explanation of Unexpected Outcomes	High	Unexpected outcomes were satisfactorily explained.

Additional Comments: None

Overall Quality Determination High

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Aquatic (freshwater); Water; Dermal (topical application), Not determined by study authors (i.e., chemical of interest in exposure water, but unable to 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:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3080106

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	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	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 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 Concentration	Low	Exposure concentrations were not measured or measurements were not reported.
	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	Medium	Only two concentrations were tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	An insoluble chemical was tested.
Domain 4: Test Organism				
	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 Conditions	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	20 plants and three replicates seemed adequate.
Domain 5: Outcome Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Aquatic (freshwater); Water; Dermal (topical application), Not determined by study authors (i.e., chemical of interest in exposure water, but unable to 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:	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 adequate.
	Metric 17:	Outcome Assessment Methodology	Medium	The outcome assessment methodology cited methods for determining attributes.
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Aquatic (freshwater); Water; Dermal (topical application), Not determined by study authors (i.e., chemical of interest in exposure water, but unable to 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 (serpentine) (CASRN 12001-29-5)
HERO ID:	3080106

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	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	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 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 Concentration	Low	Exposure concentrations were not measured or measurements were not reported.
	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	Medium	Only two concentrations were tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	An insoluble chemical was tested.
Domain 4: Test Organism				
	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 Conditions	High	All pretreatment conditions were the same for control and exposed organisms.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	20 plants and three replicates seemed adequate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Aquatic (freshwater); Water; Dermal (topical application), Not determined by study authors (i.e., chemical of interest in exposure water, but unable to 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 (serpentine) (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 Assessment	Low	Details regarding the execution of the study protocol for outcome assessment were limited.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 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 20(1):19-25.
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Cavia porcellus*; Adult
Health Outcome:	Mechanistic-Biomarkers (exposure and effect)-Gastrointestinal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	1797399

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	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.
Domain 3: Exposure Characterization				
	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	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was suitable for these endpoints.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/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 Organism				
	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 Replicates per Group	Low	It was reported there were 60 animals per treatment, but no replicates were used.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.

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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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Cavia porcellus*; Adult
Health Outcome:	Mechanistic-Biomarkers (exposure and effect)-Gastrointestinal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	1797399

Domain	Metric		Rating	Comments
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcomes of interest.
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Statistical analysis was performed and 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: None

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 20(1):19-25.
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Cavia porcellus*; Adult
Health Outcome:	Gastrointestinal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	1797399

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	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.
Domain 3: Exposure Characterization				
	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	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	High	The exposure duration was suitable for these endpoints.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/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 Organism				
	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 Replicates per Group	Low	It was reported there were 60 animals per treatment, but no replicates were used.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcomes of interest.

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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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; 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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Statistical analysis was performed and 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: None

Overall Quality Determination 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, Media, Path:	Terrestrial; Food/Diet; Dietary
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
Domain 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	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/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	The exposure was via gavage.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized, but they were fasted.
	Metric 15:	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	Metric 17:	Outcome Assessment Methodology	High	The outcome assessment methodology reported the intended outcome of interest.

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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 Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 characteristics post exposure.

Overall Quality Determination 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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	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/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	The exposure was via gavage.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized, but they were fasted.
	Metric 15:	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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 characteristics post exposure.

Overall Quality Determination 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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Cavia porcellus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
Chemical:	anthophyllite (CASRN 17068-78-9)
HERO ID:	1060372

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	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	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/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	The exposure was via gavage.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized, but they were fasted.
	Metric 15:	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Cavia porcellus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
Chemical:	anthophyllite (CASRN 17068-78-9)
HERO ID:	1060372

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 characteristics post exposure.

Overall Quality Determination 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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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 the 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 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 Concentration	Low	Exposure concentrations were not measured.
	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/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	The exposure was via gavage.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Medium	The test organisms were adequately described, but the ITRC source wasn't defined.
	Metric 14:	Acclimatization and Pretreatment Conditions	Medium	The study did not report whether test organisms were acclimatized, but they were fasted.
	Metric 15:	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if they were adequate.
	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:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 characteristics post exposure.

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
Domain 1: Test Substance				
	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 asbestos 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.
Domain 3: Exposure Characterization				
	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 consistently 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 written. 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 pathological 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 Organism				
	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.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported whether the fowl were acclimatized to test conditions.
	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 Assessment				
	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 information 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 / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not performed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a description 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 outcomes. Little information on methods used and methods assessment prevents characterization of unexpected outcomes.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
Additional Comments:	This form is for Crocidolite. This paper was on the effects of undetermined asbestos fibers, amosite and crocidolite on white leghorn fowl after being injected 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.		

Overall Quality Determination Low

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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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.
Domain 3: Exposure Characterization				
	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 consistently 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 written. 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 pathological 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 Organism				
	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.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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 Assessment				
	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 information 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 / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not performed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a description 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 outcomes. Little information on methods used and methods assessment prevents characterization of unexpected outcomes.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric	Rating	Comments
Additional Comments:	This form is for amosite; life stage Pullet, 3 Month(s); exposure duration 4 years; study duration 48 months; 1ml dose. This paper was on the effects of undetermined asbestos fibers, amosite and crocidolite on white leghorn fowl after being injected 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.		

Overall Quality Determination Low

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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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.
Domain 3: Exposure Characterization				
	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 consistently 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 written. 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 pathological 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 Organism				
	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.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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 Assessment				
	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 information 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 / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not performed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a description 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 outcomes. Little information on methods used and methods assessment prevents characterization of unexpected outcomes.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric	Rating	Comments
Additional Comments:	This form is for Crocidolite; lifestage Pullet, 3 Month(s); exposure and study duration 48 months; 1ml dose. This paper was on the effects of undetermined asbestos fibers, amosite and crocidolite on white leghorn fowl after being injected 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.		

Overall Quality Determination Low

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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
Domain 1: Test Substance				
	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 asbestos 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.
Domain 3: Exposure Characterization				
	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 consistently 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 written. 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 pathological 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 Organism				
	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.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
	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 Assessment				
	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 information 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 / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not performed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a description 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 outcomes. Little information on methods used and methods assessment prevents characterization of unexpected outcomes.

Additional Comments: This form is for amosite. This paper was on the effects of undetermined asbestos fibers, amosite and crocidolite on white leghorn fowl after being injected 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:	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, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
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
Overall Quality Determination		**Low**	

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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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.
Domain 3: Exposure Characterization				
	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 consistently 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 written. 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 pathological 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 Organism				
	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.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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 Assessment				
	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 information 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 / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	N/A	This study focused on pathological findings and thus statistical analysis was not performed.
	Metric 22:	Reporting of Data	Medium	Results were described in the text for most of the treatments. There was not a description 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 outcomes. Little information on methods used and methods assessment prevents characterization of unexpected outcomes.

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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, Media, Path:	Terrestrial; N/A (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 (riebeckite) (CASRN 12001-28-4)-amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3664651

Domain	Metric	Rating	Comments
Additional Comments:	This form is for asbestos; life stage 2-6 years; exposure and study duration 1 year; 0.5 ml dose. This paper was on the effects of undetermined asbestos fibers, amosite and crocidolite on white leghorn fowl after being injected 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.		

Overall Quality Determination Low

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	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 Characterization				
	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 consistently 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 for 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 Organism				
	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 Conditions	Low	It was not reported if the hamsters were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 5 experimental groups with 10 animals in each group.

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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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	3615254

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 Control				
	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 Presentation and Analysis				
	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: This form is for chrysotile. This study was performed on Syrian hamsters. 5 different asbestos fibers were implanted into the cheek pouch, which was examined daily for changes in vascularization. The gastrointestinal outcome was selected because this study was conducted in the mouth of the hamster and exposure effects were assessed in the mouth. No control was reported and thus the rating was unacceptable.

Overall Quality Determination Uninformative

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	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 Characterization				
	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 consistently 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 for 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 Organism				
	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 Conditions	Low	It was not reported if the hamsters were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 5 experimental groups with 10 animals in each group.
Domain 5: Outcome Assessment				

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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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	3615254

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 Control				
	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 Presentation and Analysis				
	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: This form is for Crocidolite. This study was performed on Syrian hamsters. 5 different asbestos fibers were implanted into the cheek pouch, which was examined daily for changes in vascularization. The gastrointestinal outcome was selected because this study was conducted in the mouth of the hamster and exposure effects were assessed in the mouth. No control was reported and thus the rating was unacceptable.

Overall Quality Determination Uninformative

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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	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 Characterization				
	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 consistently 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 for 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 Organism				
	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 Conditions	Low	It was not reported if the hamsters were acclimated to test conditions.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	There were 5 experimental groups with 10 animals in each group.
Domain 5: Outcome Assessment				

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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:	Overall Duration: 11 - 21 days; Exposure Duration: 11 - 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Dermal (topical application)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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:	3615254

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 Control				
	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 Presentation and Analysis				
	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: This form is for amosite. This study was performed on Syrian hamsters. 5 different asbestos fibers were implanted into the cheek pouch, which was examined daily for changes in vascularization. The gastrointestinal outcome was selected because this study was conducted in the mouth of the hamster and exposure effects were assessed in the mouth. No control was reported and thus the rating was unacceptable.

Overall Quality Determination Uninformative

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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism health.
	Metric 17:	Outcome Assessment Methodology	High	The assessment methodology was sensitive and appropriate for the outcomes of interest.

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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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 body weight for short range fibers.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Development/Growth
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; 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 / Variable Control				
	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 Presentation and Analysis				
	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 weight.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 organisms exposed to intermediate range fibers.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 organisms.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 amosite.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 short range fibers.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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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Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 organisms exposed to short range fibers.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 intermediate range fiber exposre.

Overall Quality Determination 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 hamsters. Environmental Health Perspectives 53:25-Nov.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Administration	Medium	Reporting omissions are unlikely to have a substantial impact on results.
	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/ 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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to the maintenance of organism 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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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Adult
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	709665

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 exposure to intermediate range fibers.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Lak:LVG; Juvenile
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3581049

Domain		Metric	Rating	Comments
Domain 1: Test Substance				
	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 collected 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				
	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 Characterization				
	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 consistently 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 Organism				
	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.

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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.
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Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Lak:LVG; Juvenile
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3581049

Domain	Metric		Rating	Comments
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	It was not reported if the organism were acclimated to test conditions.
	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 Assessment				
	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 / Variable Control				
	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 Presentation and Analysis				
	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: This was a long term hamster study where the hamsters were exposed to asbestos and taconite tailings via drinking water. There were two groups also 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 mortality, which was reported in Tables 3 and 4.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Lak:LVG; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3581049

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 collected 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				
	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 Characterization				
	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 consistently 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 Organism				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mesocricetus auratus*; Lak:LVG; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
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 Assessment				
	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 / Variable Control				
	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 Presentation and Analysis				
	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 also 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.

Overall Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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 collected 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				
	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 Characterization				
	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 consistently 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 Organism				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	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 Assessment				
	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 / Variable Control				
	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 Presentation and Analysis				
	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: This was a long term hamster study where the hamsters were exposed to asbestos and taconite tailings via drinking water. There were two groups also 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 development/growth, which was reported in Tables 5, 6a, and 6b.

Overall Quality Determination High

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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
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
Domain 1: Test Substance				
	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 reasonable.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Characterization				
	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 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 Organism				
	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 blastocysts were acclimatized prior to treatment.
	Metric 15:	Number of Organisms and Replicates per Group	Low	The replicates were not well described. There were 10 blastocysts per well.
Domain 5: Outcome Assessment				
	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.

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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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
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 / Variable Control				
	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 Presentation and Analysis				
	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 of the study assessed the number of pregnant organisms, the number of implants, the fetal sex ratio of the organisms, and the number of fetuses.

Overall Quality Determination Medium

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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
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
Domain 1: Test Substance				
	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	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 Characterization				
	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 Organism				
	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 blastocysts were acclimatized prior to treatment.
	Metric 15:	Number of Organisms and Replicates per Group	Low	The study did not report whether blastocysts were acclimatized prior to treatment.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Medium	The culture methods were referenced and described. Some housing details were provided 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.

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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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
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 was conducted on day 18 of gestation.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 malformed fetuses.

Overall Quality Determination Low

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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Organism				
	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 blastocysts were acclimatized prior to treatment.
	Metric 15:	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 Assessment				
	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.

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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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: This portion of the study assessed the percent of resorptions and the number of dead fetuses.

Overall Quality Determination Medium

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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 Organism				
	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 blastocysts were acclimatized prior to treatment.
	Metric 15:	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 Assessment				
	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.

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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: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	The statistical analysis was not adequately described.
	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	The lack of significance from the control group was discussed by the authors in the Discussion. Data was presented with standard error.

Additional Comments: This portion of the study assessed the fetal weight and the percent of stunted fetuses.

Overall Quality Determination Medium

Study Citation:	Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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	N/A	There was a control group and one treatment group (100 microgram asbestos per mL).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Asbestos is considered insoluble.
Domain 4: Test Organism				
	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 blastocysts were acclimatized prior to treatment.
	Metric 15:	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Culture methods were referenced and described.
	Metric 17:	Outcome Assessment Methodology	High	Asbestos fiber presence was described in the methods.
	Metric 18:	Consistency of Outcome Assessment	High	The outcome methodology took place after a 4 hour exposure.

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Study Citation:	Schneider, V., Maurer, R. R. (1977). Asbestos and embryonic development. Teratology 15(3):273-279.
Duration:	Overall Duration: 0 - 4 days (0-96h); Exposure Duration: 0 - 4 days (0-96h)
Exposure Route, Media, Path:	Terrestrial; Cell Culture Media; Not determined by study authors (i.e., chemical of interest in exposure water, but unable to determine exact uptake route)
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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	Medium	There was no information suggesting differences in blastocyst survival during the four hours.
Domain 7: Data Presentation and Analysis				
	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 asbestos in blastocysts.

Overall Quality Determination Low

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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
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
Domain 1: Test Substance				
	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				
	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 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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	A suspension was used, but few 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 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 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 pregnancy 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 Organism				
	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 Conditions	High	The test organisms were acclimatized to test conditions.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
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.
Domain 5: Outcome Assessment				
	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 Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

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 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	Study contained a control group (saline gavage).
	Metric 5:	Negative Control Response	High	Mean weight gain of pups is shown in Figure 2 and described in the text.
	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 Preparation	Medium	A suspension was used but few 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 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 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 pregnancy occurred.
	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 (gavage).
Domain 4: Test Organism				
	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 Conditions	High	The test organisms were acclimatized to test conditions.
	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.
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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

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 sacrifice. 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).
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: None

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

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 source was stated.
	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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	A suspension was used but few 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 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 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 pregnancy 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 Organism				
	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 Conditions	High	The test organisms were acclimatized to test conditions.
	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.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	Environmental conditions were not sufficiently reported to evaluate if adequate.
	Metric 17:	Outcome Assessment Methodology	High	Non-sacrifice death of pups was recorded.
	Metric 18:	Consistency of Outcome Assessment	Medium	It is unclear if counts were made daily.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Statistical methods were adequately described.
	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 23:	Explanation of Unexpected Outcomes	Medium	Variability is not necessarily applicable for reporting total number of dead pups.

Additional Comments: None

Overall Quality Determination Low

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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

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 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 3: Exposure Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	A suspension was used, but few 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 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 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 pregnancy occurred.
	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 (gavage).
Domain 4: Test Organism				
	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 Conditions	High	The test organisms were acclimatized to test conditions.
	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.

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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, Media, Path:	Terrestrial; N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; ICR; Adult
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758926

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 Assessment	Medium	Litter size was presumably determined at time of birth.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination — Uninformative

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, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Medium	Some housing details were provided; diet, size of cages, and type of bedding not were described.

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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, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (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 Assessment	High	Fetuses were weighed on day 18 of gestation.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Discussion. Data was presented with standard error.

Additional Comments: This portion of the study assessed fetal weight and the percent of stunted organisms.

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; Water; Dietary
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
Domain 1: Test Substance				
	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 control was included.
	Metric 5:	Negative Control Response	Medium	The response of the control group was shown in Table 1; a higher number of malformations 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 Characterization				
	Metric 7:	Experimental System/Test Media 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 quantitation was described.
	Metric 10:	Exposure Duration and Frequency	High	It was unclear if the exposure commenced prior to pregnancy. If the exposure 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 Organism				
	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 Assessment				

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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, Media, Path:	Terrestrial; Water; Dietary
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 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 Assessment	High	The outcome methodology was conducted on Day 18 of gestation.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 malformed organisms.

Overall Quality Determination Low

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, Media, Path:	Terrestrial; Water; Dietary
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
Domain 1: Test Substance				
	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 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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The preparation of the stock solution was described, and the water was renewed daily. It was unclear if treatment concentrations were prepared straight from the stock solution or 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 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 Organism				
	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 Assessment				
	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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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, Media, Path:	Terrestrial; Water; Dietary
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 was conducted on Day 18 of gestation.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Statistical analysis was performed (described in footnote of Table 1).
	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 difference in outcomes in treatments vs control group) were explained by the authors in the discussion section.

Additional Comments: This portion of the study assessed the number of pregnant organisms, the number of implants, the number of fetuses, and the fetus sex ratio.

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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				
	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 6:	Randomized Allocation	Medium	Female mice were randomly distributed.
Domain 3: Exposure Characterization				
	Metric 7:	Experimental System/Test Media 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 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 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 Organism				
	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 Assessment				
	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.

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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, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; CD-1; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	182

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 applies to percent resorptions and the number of dead fetuses.

Overall Quality Determination 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 Duration: > 21 days; Exposure Duration: > 21 days
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
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	6867451

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	The crocidolite was prepared in Hank's solution, and 10mg was injected intraperitoneally into each mouse.
	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. It was unclear how much solution was injected.
	Metric 9:	Measurement of Test Substance Concentration	Low	It was not reported if the crocidolite was measured.
	Metric 10:	Exposure Duration and Frequency	High	Exposure was for the lifetime of the mouse or until the mouse developed illness or ascites.
	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 responses 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 Organism				
	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 Cumberland 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.

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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 Duration: > 21 days; Exposure Duration: > 21 days
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
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	6867451

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 dead 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 tumors.
	Metric 18:	Consistency of Outcome Assessment	Low	It was unclear how often mice were monitored for mortality. Mice were monitored twice weekly for illness or ascites.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 control, nor did it appear that statistical analysis was performed on the mortality data, thus the unacceptable rating.

Overall Quality Determination Uninformative

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 Duration: > 21 days; Exposure Duration: > 21 days
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:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	6867451

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 Concentration	Low	It was not reported if the crocidolite was measured.
	Metric 10:	Exposure Duration and Frequency	High	Exposure was for the lifetime of the mouse or until the mouse developed illness or ascites.
	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 responses 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 Organism				
	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 Cumberland 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 Assessment				

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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 Duration: > 21 days; Exposure Duration: > 21 days
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:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	6867451

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 / Variable Control				
	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 Presentation and Analysis				
	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: 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 development of malignant mesothelioma data presented. The study authors did not report the use of a negative control, thus the unacceptable rating. No data evaluation was done on the tumor induction through cultured tumors portion of the study.

Overall Quality Determination Uninformative

Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Air; Inhalation
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; Strain A male x Strain C female; Juvenile
Health Outcome:	Respiratory
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3617192

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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				
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Medium	There were limited details in the preparation of the asbestos concentration. Details on 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 150,000,000-300,000,000 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.

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Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Air; Inhalation
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; Strain A male x Strain C female; Juvenile
Health Outcome:	Respiratory
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3617192

Domain	Metric		Rating	Comments
	Metric 12:	Testing at or Below Solubility Limit	N/A	This is an asbestos study via inhalation.
Domain 4: Test Organism				
	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. Brittner 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 conditions 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 Assessment				
	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 assessment. The assessment of the lungs was not well described.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	Raw data was provided. It may be possible to perform independent statistical analysis.
	Metric 22:	Reporting of Data	High	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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Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Air; Inhalation
Taxa, Species, Age:	Vertebrate; Mammalian; *Mus musculus*; Strain A male x Strain C female; Juvenile
Health Outcome:	Respiratory
Chemical:	asbestos (CASRN 1332-21-4)-chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3617192

Domain	Metric	Rating	Comments
	Metric 23: Explanation of Unexpected Outcomes	Low	Variability was not reported.

Additional Comments: This was an asbestos exposure via inhalation to mice. The mice were assessed for pulmonary tumors at 19 or 24 months. Study authors reported a large amount of cannibalism in test mice along with infection and other accidents. This creates concern regarding biomass loading and the health of the animals, therefore this study was rated as unacceptable. The study was supposed to be a lifetime study, but was cut short due to the issues above. The respiratory outcome was selected as lungs were assessed.

Overall Quality Determination 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.
Duration:	Overall Duration: 4 - 10 days; Exposure Duration: 4 - 10 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
Domain 1: Test Substance				
	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				
	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 Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Details of exposure administration were not elaborated on.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	Low	The duration of exposure was shorter than common dietary rat exposures.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	Medium	Only two exposure levels were tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Low	Few details were reported, such as initial weight.
	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 organisms and/or replicates was not reported.
Domain 5: Outcome Assessment				
	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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 versus allowed to live the remainder of their life span.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584909

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Low	It was not reported when the rats were killed.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/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

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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/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

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 rat 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 if excessive variability was present.

Additional Comments: None

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	Authors state lack of statistical significance in 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 Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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	It was not reported when rats were killed.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Mortality
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Low	Authors state lack of statistical significance in text of results, but the test was not described.
	Metric 22:	Reporting of Data	Uninformative	There is 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 Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 there was some description included in the text.
	Metric 23:	Explanation of Unexpected Outcomes	High	Any unexpected outcomes were satisfactorily explained.

Additional Comments: None

Overall Quality Determination Medium

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; 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 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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 eight and six rats for this analysis from treatment and control, respectively.
Domain 5: Outcome Assessment				
	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:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; 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 / Variable Control				
	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 Presentation and Analysis				
	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 the amosite treatment only.

Overall Quality Determination Medium

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 rat 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 if excessive variability was present.

Additional Comments: None

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 rat 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 if excessive variability was present.

Additional Comments: None

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	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.
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; HAN spf Wistar; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3584909

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination Medium

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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 on when the rats were weighed.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	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 / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination — Uninformative

Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	Low	Authors cited methodology; however the cited methodology does not adequately describe 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 asbestos/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/ Spacing of Exposure Levels	N/A	There was only one exposure concentration.
	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 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 Assessment				
	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 on when the rats were weighed.

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Study Citation:	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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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

Overall Quality Determination — Uninformative

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
	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.
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 was for the 13 month exposure duration.

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Cellular (Histology-Histological changes, general, Response Site: Gastrointestinal tract).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Growth (Development-Abnormal, Deformation, Response Site: Not reported).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Crocidolite; growth/development; exposure duration 2-52 weeks; study duration 1 yearCellular (Histology-Histological changes, general, Response Site: Gastrointestinal tract); 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.

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 was for Crocidolite; Exposure duration ~1-~8 Week(s); Study Duration ~2 Month(s)Accumulation (Accumulation-Residue, Response Site: Feces, Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 was for Bioaccumulation; 2-52 Week(s) exposure duration.

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration ~1-~8 Week(s); Study Duration ~2 Month(s); Accumulation (Accumulation-Residue, Response Site: Feces, Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 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.

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration ~1-~8 Week(s); Study Duration ~2 Month(s); Accumulation (Accumulation-Residue, Response Site: Feces, Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration 13 Month(s); Study Duration 13 Month(s). Accumulation (Accumulation-Residue, Response Site: Feces, Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Accumulation (Accumulation-Residue, Response Site: Feces, Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Cellular (Cell(s)-Cell changes, Organelle changes, Response Site: Gastrointestinal tract, Lymph node, Small intestine).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Cellular (Histology-Histological changes, general, Response Site: Gastrointestinal tract).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Chrysotile; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Growth (Development-Abnormal, Deformation, Response Site: Not reported).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Accumulation (Accumulation-Residue, Response Site: Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 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.

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
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) (CASRN 12172-73-5)
HERO ID:	3615355

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration 13 Month(s); Study Duration 13 Month(s);Accumulation (Accumulation-Residue, Response Site: Gut).

Overall Quality Determination Medium

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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 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 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” section.
	Metric 6:	Randomized Allocation	Low	It was not reported how the rats were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 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 Organism				
	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; SPF Han; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Gastrointestinal
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 Assessment				
	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 addition 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 Control				
	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 Presentation and Analysis				
	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 for Amosite; Exposure duration 2-52 Week(s); Study Duration 1 Year(s); Cellular (Cell(s)-Cell changes, Organelle changes, Response Site: Gastrointestinal tract ,Lymph node, Small intestine).

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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 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 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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 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 Control				
	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 Presentation and Analysis				
	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 1.

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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 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 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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 Characterization				
	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 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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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	Medium	Authors did not address the asbestos levels found in control organs.

Additional Comments: This is for experiment 3.

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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 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 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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 1.

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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 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 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.
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Domain 4: Test Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups..
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 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 Concentration	Low	Exposure concentrations were not measured.
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	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 1.

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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 Preparation	Low	The study provided few details on exposure media preparation.
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	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 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups..
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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				
	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 Characterization				
	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 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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	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.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
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
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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	Medium	Authors did not address the asbestos levels found in control organs.

Additional Comments: This is for experiment 3.

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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.
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 Characterization				
	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 Concentration	Low	The exposure concentration was not measured.
	Metric 10:	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 Organism				
	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 standard laboratory diet group contained 121 rats.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	Medium	Conditions were adequately explained, but the amount of diet was not described.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (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 / Variable Control				
	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 Presentation and Analysis				
	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 also applies to the preliminary IP experiment.

Overall Quality Determination Medium

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: Not-reported; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

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 source was stated.
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.
Domain 2: Test Design				
	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 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 Characterization				
	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 Concentration	Low	Exposure concentration was not measured.
	Metric 10:	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/ Spacing of Exposure Levels	N/A	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 prior to conducting experiments.
	Metric 15:	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 Assessment				
	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.

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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: Not-reported; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (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 / Variable Control				
	Metric 19:	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 Presentation and Analysis				
	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 documented.

Overall Quality Determination 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: Not-reported; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Mechanistic-Cell signaling/function-Kidney/renal
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

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 source was stated.
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.
Domain 2: Test Design				
	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 (cGMP) and appears reasonable for cAMP. There was no explanation provided for why standard laboratory diet control response was equal to that of asbestos group for cGMP, 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 Characterization				
	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 Concentration	Low	Exposure concentration was not measured.
	Metric 10:	Exposure Duration and Frequency	High	The duration of exposure was reported (24 months) and suitable for the study type. The study was terminated when rats were 33 months of age.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	N/A	One concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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	Low	Although there were 36 and 30 rats used in asbestos and cellulose control groups, respectively, 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.
Domain 5: Outcome Assessment				

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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: Not-reported; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Mechanistic-Cell signaling/function-Kidney/renal
Chemical:	chrysotile (serpentine) (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 Assessment	Medium	Rats were terminated at 33 months of age. Presumably, the weanlings were 1 month of age when the study commenced, but this was not explicitly stated.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Uninformative	It does not appear that statistics were conducted.
	Metric 22:	Reporting of Data	High	Data for exposure-related findings were presented for each treatment and control group in Figures 4 and 5.
	Metric 23:	Explanation of Unexpected Outcomes	Medium	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 groups, but far higher in the other control group.

Additional Comments: cAMP was documented.

Overall Quality Determination Medium

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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

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 source was stated.
	Metric 3:	Test Substance Purity	Medium	Cited references provided characterization of the asbestos.
Domain 2: Test Design				
	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 Characterization				
	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 Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	Exposure Duration and Frequency	High	Exposure duration was 6 weeks.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	High	Five doses were tested (1-20% asbestos in diet).
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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	Ten rats per treatment group, 10 rats per cellulose control group, and 20 standard diet control rats were utilized in the experiment.
Domain 5: Outcome Assessment				
	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 start of study (this was not stated). Total weight was not stated.
	Metric 18:	Consistency of Outcome Assessment	Low	Not explicitly stated when the rats were weighed. Figure 1 legend indicates weight gain was determined at 6 weeks of exposure.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination — 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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3616802

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 source was stated.
	Metric 3:	Test Substance Purity	Medium	The cited references provided characterization of the asbestos.
Domain 2: Test Design				
	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 observation of mesothelioma.
	Metric 6:	Randomized Allocation	Low	Random allocation was not stated.
Domain 3: Exposure Characterization				
	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 explicitly stated.
	Metric 9:	Measurement of Test Substance Concentration	Low	Exposure concentrations were not measured.
	Metric 10:	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/ Spacing of Exposure Levels	High	Three asbestos doses were used: 5.9 mg, 17.1 mg, and 29.4 mg.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via gavage and IP injection.
Domain 4: Test Organism				
	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	Low	Twenty-six rats were gavaged with asbestos (authors stated they were divided into three 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 gavaged 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				

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fisher 344, SPF stock; Juvenile
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (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 between 4-8 months post-treatment.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 also applies to the preliminary IP experiment.

Overall Quality Determination Uninformative

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3619879

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 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 asbestos 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 3: Exposure Characterization				
	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: Test Organism				
	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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3619879

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 ascites developed, the rat was killed and the abdominal organs were inspected. Tissue was taken for histological examination.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: This study was on the effect of intraperitoneal injection of chrysotile and crocidolite in rats. Rats were then observed for the development of malignant mesothelioma. This study received an unacceptable ranking because the authors did not report the use of a negative control.

Overall Quality Determination Uninformative

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3619879

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 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 asbestos 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 3: Exposure Characterization				
	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: Test Organism				
	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 Assessment				

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; N/A (e.g., injection); Injection
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3619879

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 Assessment	High	Animals were assessed daily for signs and symptoms of abdominal tumors. Once ascites developed, the rat was killed and the abdominal organs were inspected. Tissue was taken for histological examination.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: This study was on the effect of intraperitoneal injection of chrysotile and crocidolite in rats. Rats were then observed for the development of malignant mesothelioma. This study received an unacceptable ranking because the authors did not report the use of a negative control.

Overall Quality Determination Uninformative

Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar; Adult
Health Outcome:	Respiratory
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	478543

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.
	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 Characterization				
	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	Medium	Exposures were administered consistently across study groups, although quantity consumed 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/ Spacing of Exposure Levels	High	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 Organism				
	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	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 Assessment				
	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.

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Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar; Adult
Health Outcome:	Respiratory
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	478543

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Medium	There was incomplete reporting of minor details of outcome assessment protocol execution.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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: There were multiple histopathological results reported for lung and pleura.

Overall Quality Determination Medium

Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar; Adult
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	478543

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.
	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 Characterization				
	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	Medium	Exposures were administered consistently across study groups, although quantity consumed 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/ Spacing of Exposure Levels	High	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 Organism				
	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	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 Assessment				
	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 execution.

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Study Citation:	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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Water; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar; Adult
Health Outcome:	ADME (biotransformation)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	478543

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 bodies were found in the spleen and lungs.

Overall Quality Determination 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
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Sprague-Dawly; Juvenile
Health Outcome:	Cancer/Carcinogenesis
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 Substance				
	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 Characterization				
	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 testing 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 Organism				
	Metric 13:	Test Organism Characteristics	Low	The rats were described as weanling Sprague-Dawly rats. The source of the rats was not reported.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the rats were acclimated to test conditions.

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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 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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Sprague-Dawly; Juvenile
Health Outcome:	Cancer/Carcinogenesis
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
	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 Assessment				
	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 autopsies were performed.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Analysis of the test groups compared to the controls was done by 2 x k contingency table 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: This was a dietary exposure to various sources of asbestos fibers. Exposure was either through drinking water or through food. The researchers examined the rats for tumors after the lifetime exposure.

Overall Quality Determination 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
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Substance				
	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 Characterization				
	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 testing 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 Organism				
	Metric 13:	Test Organism Characteristics	Low	The rats were described as weanling Sprague-Dawly rats. The source of the rats was not reported.
	Metric 14:	Acclimatization and Pretreatment Conditions	Low	The study authors did not report whether the rats were acclimated to test conditions.
	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.

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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 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, Media, Path:	Terrestrial; Food/Diet; Dietary
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 5: Outcome Assessment				
	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 autopsies were performed.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Analysis of the test groups compared to the controls was done by 2 x k contingency table 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: This was a dietary exposure to various sources of asbestos fibers. Exposure was either through drinking water or through food. The researchers examined the rats for tumors after the lifetime exposure.

Overall Quality Determination Medium

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: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
Domain 1: Test Substance				
	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				
	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 Preparation	Low	The study provided only limited details on the measures taken to appropriately prepare test concentrations.
	Metric 8:	Consistency of Exposure Administration	Medium	Details of the exposure administration were not elaborated on.
	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 adequate for a dietary rat exposure.
	Metric 11:	Number of Exposure Groups/ Spacing of Exposure Levels	Medium	Only two exposure levels were tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	Metric 13:	Test Organism Characteristics	Low	Few details were reported, such as initial weight.
	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 organisms and/or replicates was not reported.
Domain 5: Outcome Assessment				
	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.

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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: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
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
Domain 1: Test Substance				
	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	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	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 Characterization				
	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	There was not any mention of irregularities in exposure administration.
	Metric 9:	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 Organism				
	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 Assessment				

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
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 conducive 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 Assessment	High	Litter size was assessed at birth.
Domain 6: Confounding / Variable Control				
	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.
	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 Presentation and Analysis				
	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: This was a lifetime rat study. FO rats were put on an amosite or tremolite diet. The study was done on the offspring which were put on the appropriate diet post weaning. PWG with chrysotile (used mistakenly instead of amosite) was also used in one study group that went on to receive the amosite 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Cancer/Carcinogenesis
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
Domain 1: Test Substance				
	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 Characterization				
	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	There was not any mention of irregularities in exposure administration.
	Metric 9:	Measurement of Test Substance Concentration	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 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/ 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 via diet and/or gavage.
Domain 4: Test Organism				
	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	Medium	The number of test organisms was sufficient to characterize toxicological effects and it is reported in the tables in Results.
Domain 5: Outcome Assessment				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Cancer/Carcinogenesis
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	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 / Variable Control				
	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.
	Metric 20:	Outcomes Unrelated to Exposure	High	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 thought to be treatment related.
Domain 7: Data Presentation and Analysis				
	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: This was a lifetime rat study. FO rats were put on an amosite or tremolite diet. The study was done on the offspring which were put on the appropriate diet post weaning. PWG with chrysotile was also inadvertently used (instead of gavage with 1% amosite) in one study group that went on to receive the amosite diet.

Overall Quality Determination Medium

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Behavioral
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
Domain 1: Test Substance				
	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	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 Characterization				
	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	There was not any mention of irregularities in exposure administration.
	Metric 9:	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 Organism				
	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 Assessment				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Behavioral
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 18:	Consistency of Outcome Assessment	High	Food consumption was measured weekly per cage.
Domain 6: Confounding / Variable Control				
	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.
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Uninformative	It does not appear that statistical analysis was performed on food consumption of treated 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.

Additional Comments: This was a lifetime rat study. FO rats were put on an amosite or tremolite diet. The study was done on the offspring which were put on the appropriate diet post weaning. PWG with chrysotile (used mistakenly instead of amosite) was also used in one study group that went on to receive the amosite 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; 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
Domain 1: Test Substance				
	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 Table 7, and it appears adequate.
	Metric 6:	Randomized Allocation	Medium	The study reported that organisms were randomly allocated into study groups.
Domain 3: Exposure Characterization				
	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	There was not any mention of irregularities in exposure administration.
	Metric 9:	Measurement of Test Substance Concentration	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 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/ 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 was via diet and/or gavage.
Domain 4: Test Organism				
	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	Medium	The number of test organisms was sufficient to characterize toxicological effects and it is reported in Table 7 in Results.
Domain 5: Outcome Assessment				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; 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 / Variable Control				
	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.
	Metric 20:	Outcomes Unrelated to Exposure	High	Details regarding test organism attrition and outcomes unrelated to exposure (e.g., infection) were reported for each study group and there were no differences among groups that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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: This was a lifetime rat study. FO rats were put on an amosite or tremolite diet. The study was done on the offspring which were put on the appropriate diet post weaning. PWG with chrysotile was also inadvertently used (instead of gavage with 1% amosite) in one study group that went on to receive the amosite diet.

Overall Quality Determination Medium

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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Development/Growth
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
Domain 1: Test Substance				
	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	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 Characterization				
	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	There was not any mention of irregularities in exposure administration.
	Metric 9:	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 Organism				
	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 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 Assessment				
	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.

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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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet, N/A (e.g., injection); Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Fischer 344; Embryo
Health Outcome:	Development/Growth
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 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 / Variable Control				
	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.
	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 Presentation and Analysis				
	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 or figure were presented. No body weights 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.

Additional Comments: This was a lifetime rat study. FO rats were put on an amosite or tremolite diet. The study was done on the offspring which were put on the appropriate diet post weaning. PWG with chrysotile (used mistakenly instead of amosite) was also used in one study group that went on to receive the amosite 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:	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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 process was specifically identified.
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.
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 Characterization				
	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	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Each lot was analyzed.
	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	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 animals were used. Individuals were used as 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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	crocidolite (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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 process was specifically identified.
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.
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 Characterization				
	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	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Each lot was analyzed.
	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	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 animals were used. Individuals were used as 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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 process was specifically identified.
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.
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 Characterization				
	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	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Each lot was analyzed.
	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	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 animals were used. Individuals were used as 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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Behavioral
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 process was specifically identified.
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.
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 Characterization				
	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	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Each lot was analyzed.
	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	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 animals were used. Individuals were used as 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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Behavioral
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination 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:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Reproductive/Teratogenic
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 process was specifically identified.
	Metric 3:	Test Substance Purity	High	Chemical purity was reported as 99%.
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 Characterization				
	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	Exposures were administered consistently across study groups.
	Metric 9:	Measurement of Test Substance Concentration	Medium	Each lot was analyzed.
	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	Only one concentration was tested.
	Metric 12:	Testing at or Below Solubility Limit	N/A	Exposure was via diet.
Domain 4: Test Organism				
	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 animals were used. Individuals were used as 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.

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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.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Reproductive/Teratogenic
Chemical:	crocidolite (riebeckite) (CASRN 12001-28-4)
HERO ID:	3613439

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 Quality Determination High

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	Metric 7:	Experimental System/Test Media Preparation	High	Preparation of asbestos in feed 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 analysis 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 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Medium	Fetal weights were determined presumably at birth.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 analysis 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 Organism				
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive and described in Table 3.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
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: Confounding / Variable Control				
	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 Presentation and Analysis				
	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.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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.
Domain 3: Exposure Characterization				
	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 analysis 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 Organism				
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Animals were observed twice daily for mortality.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

Overall Quality Determination High

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 analysis 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 Organism				
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Behavioral
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Food consumed was reported as per day on a weekly basis.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 the text of results.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Adult
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 analysis 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 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Adult
Health Outcome:	Reproductive/Teratogenic
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	Uninformative	No statistics were performed.
	Metric 22:	Reporting of Data	Medium	Results were presented in the text as averages. No tables or figures were provided.
	Metric 23:	Explanation of Unexpected Outcomes	Low	No variability was reported.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 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 Characterization				
	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 analysis 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%.
	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 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Cancer/Carcinogenesis
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	High	Animals were observed twice daily for moribund conditions and terminated if moribund. Necropsy and histological examinations were performed on those animals and on any remaining animals at the conclusion of the study.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	Metric 21:	Statistical Methods	High	Three different methods of statistical analysis for lesion/cancer occurrence were described.
	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.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

Overall Quality Determination High

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Immune/Hematological
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 Characterization				
	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 analysis 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 Organism				
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344/N; Embryo
Health Outcome:	Immune/Hematological
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	758884

Domain	Metric		Rating	Comments
	Metric 18:	Consistency of Outcome Assessment	Low	Details regarding the execution of the study protocol for outcome assessment (e.g., timing of assessment across groups) were confusing, limited, or not reported.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Table D.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

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 Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
Domain 1: Test Substance				
	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 Characterization				
	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 analysis 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 Organism				
	Metric 13:	Test Organism Characteristics	High	The strain, sex, and source of animals was stated.
	Metric 14:	Acclimatization and Pretreatment Conditions	High	Adult rats of F0 generation were acclimated 4-5 weeks prior to testing.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	The numbers of test organisms were reported in Table 2 and were appropriate.
Domain 5: Outcome Assessment				
	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.

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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 Program Technical Report Series 295:1-390.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 Assessment	Low	Details regarding the execution of the study protocol for outcome assessment (e.g., timing of assessment across groups) were confusing, limited, or not reported.
Domain 6: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 Table D.
	Metric 23:	Explanation of Unexpected Outcomes	Low	Variability of the data was not reported.

Additional Comments: This form applies to both short-range and intermediate-range chrysotile treatments in feed as well as the preweaning gavage/feed treatment group.

Overall Quality Determination — Uninformative

Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and composition.
	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 Characterization				
	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 Organism				
	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 Assessment				

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Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and composition.
	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 Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.

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Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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 / Variable Control				
	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 Presentation and Analysis				
	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 consumption see Appendix H.

Overall Quality Determination High

Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and composition.
	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 Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.

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Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
Chemical:	amosite (grunerite) (CASRN 12172-73-5)
HERO ID:	758961

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and composition.
	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 Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.

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Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Cancer/Carcinogenesis
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 / Variable Control				
	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 Presentation and Analysis				
	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: Various neoplasms, lesions, and other pathologies were reported.

Overall Quality Determination High

Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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
Domain 1: Test Substance				
	Metric 1:	Test Substance Identity	High	The test substance was identified definitively by nomenclature, specific form, and composition.
	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 Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	High	Environmental conditions of the test system were conducive to maintenance of organism health.

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Study Citation:	NTP, (1990). Toxicology and carcinogenesis studies of amosite asbestos (CAS no. 12172-73-5) in F344/N rats (feed studies).
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F300/N; Not Applicable (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 / Variable Control				
	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 Presentation and Analysis				
	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 Quality Determination High

Study Citation:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	759022

Domain		Metric	Rating	Comments
Domain 1: Test Substance				
	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				
	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 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 they were distributed.
Domain 3: Exposure Characterization				
	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 Organism				
	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 Assessment				
	Metric 16:	Adequacy of Test Conditions	Low	The study was conducted according to OECD 451. However, these details were not specified in the study.

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Study Citation:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Development/Growth
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	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 / Variable Control				
	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 Presentation and Analysis				
	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 applies to both the chrysotile-only and chrysotile+crocidolite mixture treatments.

Overall Quality Determination Uninformative

Study Citation:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; 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
Domain 1: Test Substance				
	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				
	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 Characterization				
	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 Organism				
	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 Assessment				
	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:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; 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: Confounding / Variable Control				
	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 study group. There were no differences among groups that could influence the outcome assessment.
Domain 7: Data Presentation and Analysis				
	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 2.
	Metric 23:	Explanation of Unexpected Outcomes	High	There were no unexpected outcomes.

Additional Comments: This form applies to both the chrysotile-only and chrysotile+crocidolite mixture treatments.

Overall Quality Determination Medium

Study Citation:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	759022

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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				
	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 Characterization				
	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 Organism				
	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 Assessment				
	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.

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Study Citation:	Truhaut, R., Chouroulinkov, I. (1989). Effect of long-term ingestion of asbestos fibres in rats. IARC Scientific Publication no. 90 :127-133.
Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; Wistar Han SPF; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Mortality
Chemical:	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: Confounding / Variable Control				
	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 Presentation and Analysis				
	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 applies to both the chrysotile-only and chrysotile+crocidolite mixture treatments.

Overall Quality Determination Uninformative

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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344 male; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Other (please specify below) (Choking)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3612470

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	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				
	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 Characterization				
	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	Medium	The consistency is questionable with ad libitum offering of food.
	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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344 male; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Other (please specify below) (Choking)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3612470

Domain	Metric		Rating	Comments
	Metric 15:	Number of Organisms and Replicates per Group	Medium	A suitable number was used. Individuals could serve as replicates.
Domain 5: Outcome Assessment				
	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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 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 Presentation and Analysis				
	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: Differences existed in the types of feed used as well as male vs female rats. It is unclear the extent asbestos contributed to the choking played in the study outcomes, if at all. Results of a mixture were also reported.

Overall Quality Determination Uninformative

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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344 female; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Other (please specify below) (Choking)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3612470

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	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				
	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 Characterization				
	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	Medium	The consistency is questionable with ad libitum offering of food.
	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/ 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 Organism				
	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	Low	The study did not report whether test organisms were acclimatized.
	Metric 15:	Number of Organisms and Replicates per Group	Medium	A suitable number was used. Individuals could serve as replicates.

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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, Media, Path:	Terrestrial; Food/Diet; Dietary
Taxa, Species, Age:	Vertebrate; Mammalian; *Rattus norvegicus*; F344 female; Not Applicable (e.g., fungi or algae studies) or Not Reported
Health Outcome:	Other (please specify below) (Choking)
Chemical:	chrysotile (serpentine) (CASRN 12001-29-5)
HERO ID:	3612470

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 Assessment	High	Outcomes were assessed consistently across study groups.
Domain 6: Confounding / Variable Control				
	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 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 Presentation and Analysis				
	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.

Additional Comments: Differences existed in the types of feed used as well as male vs female rats. It is unclear the extent asbestos contributed to the choking played in the study outcomes, if at all. Results of a mixture were also reported.

Overall Quality Determination — Uninformative

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.

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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, Media, Path:	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
Domain 5: Outcome Assessment				
	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 / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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.

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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, Media, Path:	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:	Exposure and study duration 21 days; 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 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.This portion of the evaluation 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 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."		

Overall Quality Determination Low

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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 / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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.

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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, Media, Path:	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:	Exposure and study duration 21 days; 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 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.This portion of the evaluation 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 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."		

Overall Quality Determination Low

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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 / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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.

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Exposure Route, Media, Path:	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:	Exposure and study duration 21 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 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.This portion of the evaluation 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 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."		

Overall Quality Determination Low

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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 / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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.

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Exposure Route, Media, Path:	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:	Exposure and study duration 21 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 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.This portion of the evaluation 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 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."		

Overall Quality Determination Low

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, Media, Path:	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:	Mortality
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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 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 Characterization				
	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 asbestos 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 Organism				
	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 4 weighed earthworms per test chamber and two replicates per treatment. More replicates or more worms may have provided a more insightful data set.

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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, Media, Path:	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:	Mortality
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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: Confounding / Variable Control				
	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.The authors indicated there may be an additional consequence with the addition 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 sediments 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 substantially, but this is dependent on the acid used."
Domain 7: Data Presentation and Analysis				
	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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Exposure Route, Media, Path:	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:	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 groups 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 creates 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 of soil pH cannot be ignored in the subsequent 30 day tests (both laboratory and field trials).		

Overall Quality Determination Low

Study Citation:	Schreier, H., Timmenga, H. J. (1986). Earthworm response to asbestos rich serpentinitic sediments. Soil Biology and Biochemistry 18(1):85-89.
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Health Outcome:	Mortality
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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 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 Characterization				
	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 asbestos 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 Organism				
	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.

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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
	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 Assessment				
	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: Confounding / Variable Control				
	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.The authors indicated there may be an additional consequence with the addition 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 sediments 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 substantially, but this is dependent on the acid used."
Domain 7: Data Presentation and Analysis				
	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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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 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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Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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." Results are also reported in figure 1. Only 15% of the control worms survived the 297 day study.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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 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 Organism				
	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.

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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, Media, Path:	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:	Mortality
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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: Confounding / Variable Control				
	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.The authors indicated there may be an additional consequence with the addition 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 sediments 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 substantially, but this is dependent on the acid used."
Domain 7: Data Presentation and Analysis				
	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). 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, Media, Path:	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:	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 297 day exposure. Worms were exposed to asbestos fibers for 297 days after which they were assessed for survival and reproduction.This portion of the evaluation 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 asbestos fibers in soil. Control worms were exposed to soil with a pH of 5.7. There were no asbestos-containing treatment 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 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.		

Overall Quality Determination Low

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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: Confounding / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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. 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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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, Media, Path:	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
Overall Quality Determination		**Low**	

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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: Confounding / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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-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. 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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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, Media, Path:	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
Overall Quality Determination		**Low**	

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, Media, Path:	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:	Reproductive/Teratogenic
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 1: Test Substance				
	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 asbestos 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 Characterization				
	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 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 Organism				
	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.

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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, Media, Path:	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:	Reproductive/Teratogenic
Chemical:	asbestos (CASRN 1332-21-4)
HERO ID:	3583167

Domain	Metric		Rating	Comments
Domain 5: Outcome Assessment				
	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 / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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 days 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. Control 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 score was ranked 'low' as a result.

Overall Quality Determination — Low

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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: Confounding / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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: 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."

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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, Media, Path:	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
Overall Quality Determination		**Low**	

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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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, Media, Path:	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
	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: Confounding / Variable Control				
	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 substantially, but this is dependent on the acidused."
Domain 7: Data Presentation and Analysis				
	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. 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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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
Exposure Route, Media, Path:	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
Overall Quality Determination		**Low**	

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, Media, Path:	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
Domain 1: Test Substance				
	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 asbestos 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 adequate.
	Metric 6:	Randomized Allocation	Low	Researchers did not report how the earthworms were divided into study groups.
Domain 3: Exposure Characterization				
	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. Researchers 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 Organism				
	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 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				

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Duration:	Overall Duration: > 21 days; Exposure Duration: > 21 days
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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
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	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.
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	Metric 21:	Statistical Methods	High	A Mann-Whitney nonparametric significance test was used to determine differences in metal content between treatments and the control.
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	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: 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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Exposure Route, Media, Path:	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
Overall Quality Determination		**Low**	