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MAS Project 14-2732
Talcum Powder Analysis
Desenex Containers



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PROJECT SUMMARY

This report provides the results for the analysis of six Desenex powder containers that were submitted to MAS by Darron Berquist on behalf of Lanier Law Firm. The Desenex Powder containers were sent to MAS and received throughout the month of January, the C.O.C's pertaining to each of the samples are found in section 2 of this notebook. All six Desenex powder containers were logged in accordingly and then placed in a secure laminar flow hood. The Desenex powder sample containers were assigned the following MAS laboratory tracking numbers listed below.

Table 1 provides a sample description summary of the Desenex powders that were analyzed for asbestos.

Table 1
Desenex Powder Sample Container Descriptions

MAS Sample No.	Product	Amount of Powder in Container (oz)	Container Code	Source of Sample
M71481-001	1990 Desenex Antifungal Powder	3.0	29751 1/90	Purchased on eBay Submitted by Darron Berquist
M71488-001	Desenex Antifungal Powder	1.5	13672	Purchased on eBay Submitted by Darron Berquist
M71502-001	Desenex Powder Zincundecate (Wallace & Tiernan)	0.25	ZPF-123-F L1	Purchased on eBay Submitted by Darron Berquist
M71503-001	1985 Desenex Antifungal Powder (Athletes Foot Can)	1.5	24218 May 85	Purchased on eBay Submitted by Darron Berquist
M71504-001	Vintage Desenex Aerosol Spray-On Powder (Medicated Foot Care)	6.0	6820	Purchased on eBay Submitted by Darron Berquist
M71505-001	1985 Desenex Antifungal Powder	1.5	23800	Purchased on eBay Submitted by Darron Berquist

OVERVIEW

This report provides the analytical results for the testing of six Desenex powder containers that MAS analyzed as requested by the Lanier Law Firm.

The talcum powder in the six Desenex Powder sample containers were analyzed for both chrysotile and amphibole asbestos using heavy liquid separation sample preparation, then analyzed by PLM and ATEM using ISO-22262-1 & 2 methods.

For chrysotile, the samples were prepared by the CSM method with heavy liquid separation (HLS), then analyzed by the ISO-22262-1 PLM using refractive index fluids 1.550 & 1.560.^{1,2}

For the detection of amphibole asbestos for the six Desenex Powder containers, the PLM sample preparation was by the New York ELAP method HLS method, and analyzed by the ISO-22262-1 method using refractive index fluid 1.605. ATEM sample preparation was by the ISO 22262-1&2 method using HLS and filter preparation and using the standard TEM methods.

Overview of Results

The CSMP Sample Preparation (with HLS) & Analyzed by the ISO 22262-1 Method

The amount of chrysotile found in the six positive Desenex Powder samples had an average chrysotile estimated volume weight concentration of 0.0007 to 0.006% (recovery weight corrected). The average amount of chrysotile bundles, found in the analysis, was 250,000 bundles per gram of talcum powder (recovery weight corrected).

The ISONY 22262-1 (with HLS) Method for Amphibole Asbestos

The analysis showed that the six Desenex powder samples were non-detect for amphibole asbestos or cleavage fragments.

ISO 22262-1&2 ATEM HLS Method for Amphibole Asbestos

Five of the six Desenex Powder samples were found to be non-detect, with a detection limit average of <41,000 structures per gram. sample M71502-001 was positive for tremolite asbestos with a detection limit of 2,790,000 tremolite bundles/fibers per gram.

MATERIALS & METHODS

Desenex Powder Sample Containers

¹ Colorado School of Mines Research Institute February 26, 1973 Report Re: Mineralogical Examination of Four Talc Samples to W.H. Ashton from W.P. Reid and W.T. Caneer.

² Colorado School of Mines Research institute April 2, 1973 Report re: Mineralogical Examination of four Samples for Tremolite and Chrysotile from W.P. Reid to W.H. Ashton.

After the Desenex Powder sample containers were logged in at MAS, the containers were transferred to the cosmetic talc archive room where all six samples were photographed in the received condition and inspected for damage or tampering. The MAS chain-of-custody documents can be found in Section 2 of this report, and photographs of each container can be found in Section 10 of this report.

Muffle Furnace

For this procedure, approximately 1 to 2 grams from each of the six talcum powder samples was removed from their containers (Sartorius Research Balance) and placed in six separate glass scintillation vials. Each scintillation vial was then placed in a Fisher Scientific Iso-temp muffle furnace Model #620 at 480°C for a minimum of 12 hours to remove any organic material. Typically, the muffle furnace samples are run overnight.

CSMP Sample Preparation Method (with HLS) for Chrysotile Asbestos

CSMP Sample Preparation

Approximately 200 milligrams from the each of the six muffled talcum powder samples were transferred into separate 15 ml centrifuge tubes (VWR 10026-076). Through the use of DI water, approximately 5 ml of adjusted HL (Lithium heteropolytungstates solution, GeoLiquids, Inc., Cat. No. LST010 (stated density of 2.85 g/cc), was diluted to a new density of 2.72 g/cc, as determined by a VWR Hydrometer, Model Number 34620-1109.

The newly diluted HL was added to each of the VWR centrifugation tubes containing the talcum powder samples and then shaken vigorously for 10 to 20 seconds. Each VWR centrifugation tube was then placed in an Ohaus Frontier 5000 series centrifuge set at 2000 RPM for 24 hours at room temperature without braking. After removing the tubes from the centrifuge, the talc/heavy liquid light fraction was pipetted off the top of each centrifuge tube. The pellet (heavy fraction) along with the DI water was then filtered onto a new 0.45um 47mm PC filter and allowed to dry under a drying lamp for 20 to 30 minutes. This washing step was repeated two more times for the sample.

After drying, the final MCE filter/talc sample (heavy fraction or pellet) was provided to the PLM analyst. The 47 mm MCE filter was weighed before HLS recovery process, then after the filtration and drying of the heavy fraction.

New York ELAP Method (with HLS Sample Preparation) for Amphibole Asbestos

Approximately 200 milligrams from the each of the six muffled talcum powder samples were transferred into separate 15 ml centrifuge tubes (VWR 10026-076). Through the use of DI water, approximately 5 ml of adjusted HL (Lithium heteropolytungstates solution, GeoLiquids, Inc., Cat. No. LST010 (stated density of 2.85 g/cc), was diluted to a new density of 2.72 g/cc, as determined by a VWR Hydrometer, Model Number 34620-1109.

The newly diluted HL was added to each of the VWR centrifugation tubes containing the talcum powder samples and then shaken vigorously for 10 to 20 seconds. Each VWR centrifugation tube was then placed in an Ohaus Frontier 5000 series centrifuge set at 2000 RPM for 24 hours at room temperature without braking. The pellet is resuspended in approx. 10 ml of DI water, shaken by hand for 30 secs and poured into a new 100 ml analytical test filter funnel (Thermo Scientific Nalgene Analytical Test Filter Funnel CN, 145-2020), containing the provided 0.45um 47mm MCE filter. This washing process is repeated two additional times. The total mixture is then filtered under vacuum. The filter is removed and placed in a new disposable plastic 50 mm petri dish and allowed to dry under a drying lamp for 20 to 30 minutes inside a laminar flow hood.

After removing the tubes from the centrifuge, the talc/heavy liquid (light fraction) was pipetted off the top of each centrifuge tube. The pellet along with the DI water was then filtered onto a new 100 ml analytical test filter funnel (Thermo Scientific Nalgene Analytical Test Filter Funnel CN, 145-2020), containing the in place 0.45um 47mm MCE filter. This washing process is repeated two additional times. The total mixture is then filtered under vacuum. The filter is removed and placed in a new disposable plastic 50 mm petri dish and allowed to dry under a drying lamp for 20 to 30 minutes inside a laminar flow head. After drying, the final MCE filter/talc sample (heavy fraction or pellet) was provided to the PLM analyst. The 47 mm MCE filter was weighed before HLS recovery process, then after the filtration and drying of the heavy fraction.

ISO 22262-1 PLM Analysis of the Samples Prepared by the CSMP & New York ELAP Method

Approximately 100 milligrams from each muffled talcum powder sample types (heavy fraction) were analyzed by the ISO 22262-1 PLM method. To determine the actual amount of talcum powder analyzed by this method, each sample type was prepared as follows: two new glass slides that are used to analyze the talcum powder sample by PLM for this project were separately weighed and recorded (Sartorius Research Balance).

Next, three talcum powder sample mounts were placed on the two glass slides (one talcum powder mount on one slide and two talcum powder mounts on the second slide). While each sample mount was transferred onto the glass slides, each of the glass slides were reweighed and recorded. Afterwards, a drop of either 1.550 or 1.560 RI fluid for the detection of chrysotile, or 1.605 RI fluid for the detection of amphibole asbestos was placed on each sample mount and stirred with the point of a scalpel blade. The three sample mounts, for each sample type were then covered with an 18 x 18 mm glass cover slip.

Each sample was then examined under elongation PLM conditions with the 530 nm analyzer plate inserted. 30 total fields per field of view (a single PLM field of view has an area of 0.785 mm^2) are examined (10 fields of view for each of the three mounts) for a total area examined of 23.55 mm^2 .

Positive identification of chrysotile and amphibole asbestos bundles was done by morphology, refractive indices, elongation, extinction angle, birefringence and pleochroism as described by the ISO 22262-1 PLM method.

In the case of the chrysotile analysis, the ISO PLM analysis protocol was used to only show how the analysis is done. However, the range of acceptable RI's for the NIST 1866 chrysotile standard, in the ISO protocol were not used. The reason for this will be discussed later in this report.

If chrysotile or amphibole asbestos are present, the PLM analyst will count the number of positively identified asbestos structures in each field of view based on the above criteria and record that number on the MAS PLM data sheet.

In addition, up to three or four representative chrysotile or amphibole asbestos bundles are photographed in both the parallel and perpendicular direction under dispersion staining, elongation, cross polars and with polarizers out. The detection limit for this method, as specified by the ISO 22262-1 method, is the finding of either 1 fiber or 1 bundle in the analysis.

In addition to the determination of whether regulated amphibole asbestos structures are present in the sample, the sample was also examined for possible amphibole cleavage fragments in 1.605 RI fluid.

If chrysotile or amphibole asbestos is present, the PLM analyst will count the number of positively identified asbestos structures in each field of view based on the above criteria and record that number on the MAS PLM data sheet. The detection limit for this method, as specified by the ISO 22262-1 method, is the finding of either 1 fiber or 1 bundle in the analysis.

TEM Sample Preparation: Amphibole Asbestos ISO 22262-2 (with HLS Sample Preparation)

The HLS sample preparation for the ATEM analysis was done by the ISO 22262-2 methodology. Approximately 25 to 30 milligrams (Sartorius Research Balance) from each muffled furnace talcum powder sample were placed into six separately labeled 15 ml centrifuge tubes (VWR 10026-076).

Approximately 5 ml of heavy liquid (Lithium heteropolytungstates solution, GeoLiquids, Inc., Cat. No. LST010 (stated density 2.85 g/cc) was added into each of the six centrifuge tubes containing the talcum powder samples, that was then prepared and shaken vigorously by hand for 10 to 20 seconds. The six centrifuge tubes were placed in an Eppendorf micro-centrifuge (Model No. 2412D) set at 2000 RPM for 24 hours at room temperature. After removing the tubes from the centrifuge, the talc/heavy liquid (light fraction) was pipetted off the top of each centrifuge tube. Deionized water was added to each centrifuge tube to bring the volume to approximately 15 ml. The 15 ml centrifuge tubes were then capped and inverted by hand 2 times to distribute the collected material in the bottom of the tube tip. Next, the 15 ml mixture was immediately and continuously filtered through either a 20 mm, 25mm or a 45mm Polycarbonate filter (PC) with a 0.22 μ m pore size. The determination of the size of the PC filters used is determined by the amount of material recovered from the HLS pellet. After each mixture was filtered, the excess heavy liquid was washed through the filter with the addition of approximately 100 ml of deionized water. The prepared PC filter was placed in a new disposable plastic 47 mm petri dish and allowed to dry at

ambient room temperature in a HEPA hood for a minimum of 2 hours. The processed PC filter sample was directly prepared onto 100 µm TEM size grids (2 for analysis and 1 for archive) using the standard TEM filter preparation protocol for PC filters.^{3, 4, 5, 6, 7}

ATEM Amphibole Asbestos Analysis: ISO 22262-1 & 2

For the ATEM analysis, 100 grid openings were analyzed between two grids (50 openings per grid). JEOL 1200EX ATEMs equipped with either a Noran or an Advanced Analysis Technologies (light element) energy dispersive x-ray analyzer (EDXA) were employed for this analysis.

The sample was analyzed at a screen magnification of 20,000X. Verification of regulated amphibole asbestos structures is done in the ATEM by the following three steps:

Morphology (Step 1)

The determination of the fibrous morphology for any potential regulated amphibole asbestos structures in the TEM sample was done by the standard ATEM methodology.^{3,5} Morphology is identified when the fibers and bundles of potential asbestos structures have substantially parallel sides with an aspect ratio of 5:1 or greater, and at least 0.5 µm in length.

Regulated Amphibole Asbestos Verification (Steps 2 & 3)

Potential fibrous amphibole asbestos structures that fit the above morphology criteria are analyzed in the ATEM by EDXA for the fiber/bundle chemistry (Step 2) and selected area electron diffraction (SAED), for the appropriate crystalline lattice measurements for amphibole asbestos (Step 3) as described in the ISO 22262-1 & 2 methods.

The detection limit for this method, as specified by the ISO 22262-1 method, is the finding of either 1 fiber or 1 bundle in the analysis.

Process Laboratory Blank

All six of the process laboratory blanks were run concurrently with each of the corresponding Desenex talcum powder sample preparations by the ATEM HLS method (amphibole asbestos). The process blank PC filter was prepared in the same exact manner as the ATEM talcum powder sample (with heavy liquid, filtration on PC filters, etc.) but without any talcum powder. For the ATEM analysis, 100 grid openings (two grids, 50 grid openings each) were analyzed for the process blank.

³ D5755-09 "Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Loading.

⁴ D5756-02 "Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust Loading by Transmission Electron Microscopy for Asbestos Mass Surface.

⁵ ISO 10312 1992-02-01, "Ambient Air Determination of Asbestos Fibers-Direct-Transfer Transmission Electron Microscopy Method.

⁶ ISO 13794 1999 07-12, "Ambient Air-Determination of Asbestos Fibers-Indirect-Transfer Transmission Electron Microscopy Method.

⁷ U.S. Environmental Protection Agency (USEPA) 1987. Asbestos Hazard Emergency Response Act, 40 CFR Part 763, Appendix A to Subpart E, USEPA, Washington D.C.

RESULTS

Desenex Powder Container Inspections

According to the chain-of-custody, the six Desenex Powder samples were sent from Lanier Law Firm. When inspected upon their received condition, all six powder samples were opened from its received original packaging and sampled. Images of each container can be found in section 10 of the notebook.

CSMP Sample Prep. (HLS)/ISO 22262-1 PLM Analysis Chrysotile Asbestos)

M71481-001, M71488-001 & M71502-001 through M71505-001

The amount of chrysotile found in six the Desenex Powder samples had an average estimated volume weight concentration of 0.0007 to 0.006% (recovery weight corrected). The average amount of chrysotile bundles was 250,000 bundles per gram of talc (recovery weight corrected).

The average birefringence (BIR) of the chrysotile bundles was calculated from the refractive index measurements and found to have a BIR classification of 0.007 which is classified as a Low birefringence (<0.01). The CSMP/ISO-PLM data sheets can be found in Sections 3 through 8 of this report.

PLM – New York ELAP Method Sample Prep. (HLS)/ ISO-22262-1 PLM Analysis for Amphibole Asbestos

M71481-001, M71488-001 & M71502-001 through M71505-001

The analysis showed that the six Desenex powder samples were non-detect for amphibole asbestos and cleavage fragments. The ISONY-PLM data sheets can be found in Sections 3 through 8 of this report.

ATEM ISO 22262-1 & 2 Amphibole Asbestos Method

M71481-001, M71488-001 & M71502-001 through M71505-001

The ISO 22262-2 ATEM heavy liquid separation method showed that five of the six of Desenex Powder samples reported a detection limit of approximately <41,000 structures/bundles per gram.

Of the six Desenex powder samples, only M71502-001 reported positive for tremolite asbestos at a concentration of approximately 2,790,000 fiber/bundles per gram of talcum powder.

The ATEM data sheets can be found in Sections 3 through 8 of this report. The summary of the ATEM results are shown in Table 2.

ATEM Process Blanks

The analyzed ATEM process blank samples showed no asbestos structures, cleavage fragments or fibrous/platy talc detected in any of the six process blanks. The ATEM data sheets can be found in Section 9 of this report.

**Table 2
Overall Summary of the Desenex Powder Asbestos Sample Analysis Results**

MAS Sample #	ATEM Amphibole Asbestos	ISO-NY PLM Wt. % Amphibole Asbestos	CSMP-PLM w/o HLS Chrys %	CSMP Weight Recovery heavy fraction	CSMP Chrys % Weight Corrected**
M71481-001	<9,000	NSD*	0.012-0.013	15.6%	0.002-0.002
M71488-001	<48,000	NSD*	0.004-0.005	68.7%	0.003-0.003
M71502-001	2,790,000	NSD*	0.004-0.007	60.5%	0.002-0.004
M71503-001	<40,000	NSD*	0.005-0.007	83.3%	0.004-0.006
M71504-001	<56,000	NSD*	0.004-0.006	17.8%	0.0007-0.0011
M71505-001	<52,000	NSD*	0.004-0.007	34.8%	0.001-0.002

*NSD: No Structure Detected **Weight Corrected

The refractive index and calculated birefringence values are shown in Table 3.

**Table 3
Overall Summary of the Calculated Chrysotile
BIR CSMP-PLM Data
(RI Fluid 1.550 & 1.650)**

MAS Sample #	Chrysotile RI Values CSMP-PLM	Birefringence Calculations
M71481-001	1.568-1.560 1.559-1.553	0.006-0.008 avg. = 0.007
M71488-001	1.569-1.561 1.568-1.558	0.008-0.010 avg. = 0.009
M71502-001	1.568-1.562 1.565-1.557	0.006-0.008 avg. = 0.007
M71503-001	1.569-1.564 1.566-1.558	0.005-0.008 avg. = 0.007
M71504-001	1.567-1.562 1.561-1.556	0.005-0.005 avg. = 0.005
M71505-001	1.568-1.566 1.564-1.557	0.002-0.007 avg. = 0.005
	α range γ 1.566-1.553 1.569-1.559	Avg. = 0.007

Estimation of the Number of Chrysotile Bundles in the Talcum Powder Samples

Using the number of chrysotile bundles counted during the PLM samples analysis, and the amount of talcum powder analyzed in a specified area on the cover slip mount per the two glass slides, the amount of chrysotile bundles per gram of talcum powder sample can be calculated.

Total chrysotile bundles in the sample is calculated as shown in the following equation:

$$(A1 \div A2) \times (CB) \div W = TCB/W$$

Where:

The detection limit for this method, as specified by the ISO 22262-1 method, is the finding of either 1 fiber or 1 bundle in the analysis.

The total area (972 mm²) that the talcum powder occupies on the two glass slides.

A2: The area (23.55 mm²) in thirty fields of view that the talcum powder occupies on the two glass slides.

CB: Number of chrysotile bundles detected in a positive sample by PLM analysis.

W: Weight of total talcum powder placed on the two glass slides.

TCB/W: Total number of chrysotile bundles per weight (grams) of talcum powder.

The results of CSMP sample preparation and ISO-NY PLM analysis calculations are shown in Table 4.

**Table 4
Summary of Estimated Chrysotile Bundles per gram Calculations
For the CSMP PLM Results**

MAS Sample #	wt. of sample grams	No. of Chrys Bundles counted	CSMP/ISO Chrysotile Bundles/g	CSMP/ISO* Chrysotile Bundles/g
M71481-001	0.0011	40	1,500,000	234,000*
M71488-001	0.0010	8	330,000	227,000*
M71502-001	0.0008	10	516,000	312,000*
M71503-001	0.0009	12	551,000	459,000*
M71504-001	0.0006	9	620,000	110,000*
M71505-001	0.0009	10	459,000	160,000*
			Avg. = 663,000	Avg. = 250,000*

Weight corrected*

The average of the amount of chrysotile bundles for the CSMP sample preparation methods for the six Desenex powder samples was 250,000 bundles per gram of talc.

DISCUSSION/CONCLUSION

The PLM analysis performed by MAS, showed that the six Desenex Powder containers that were analyzed by the CSMP sample preparation method with HLS were positive for chrysotile asbestos.

MAS' PLM analysis was able to both detect and determine the amount of chrysotile in the sample with HLS because MAS uses PLM microscopes that has higher resolution and analytical sensitivity capabilities, than your standard PLM microscope (Olympus BH2) which is more suited for analyzing asbestos added products (AAP), and for cosmetic talc samples.

In AAP (chrysotile) samples, as compared to cosmetic talc samples, has a much higher population of very large size chrysotile bundles and orders of magnitude higher concentration levels of chrysotile in these types of products.

The PLM analysis of AAP samples does not challenge the resolution of the typical PLM microscope optics, or burden the microscopist with very long sample analysis times. For example, in most PLM labs, including MAS's, the typical time required for an experienced PLM microscopist to analyze asbestos added products (AAP), where the majority of the AAP samples contain approximately 10 to 25 % asbestos, will only take about 15 and 20 minutes to complete the analysis.

With a cosmetic talc sample on the other hand, a typical PLM analysis at MAS, for either chrysotile or amphiboles asbestos, would routinely take 2 to 4 hours for a positive sample and a minimum of 20 minutes to hour for a negative sample, if there are no pigments in the sample. In order to both detect and analyze the small size of the chrysotile bundles (10 to 20 μm in length), that are typically found in cosmetic grade talcum powder, through the use of dispersion staining, the PLM microscope must have "flat" objective lenses, and a HD video camera attached to the PLM microscope that is interfaced to a high definition monitor.

The MAS PLM microscopes are state-of-the-art Leica DM2700P PLM microscopes, where all of the objective lens, including the 10X central stop dispersion lens are the flat type, also known as infinity lens, LED light source, and are coupled with state-of-the-art HD digital camera and 37" HD monitor. To detect these size chrysotile bundles, it is highly recommended that this type of PLM microscope setup should be used for the PLM analysis of cosmetic talc samples.

It is also my opinion that the PLM analysis must first analyze prepared talcum powder standards, containing UCC SG-210 or RG-144 Calidria chrysotile, to become familiar with both the size of chrysotile structures found in cosmetic talc, as well as the difference in the refractive indices for the chrysotile as compared chrysotile added products.

Both the RG-144 and RG-210 Calidria chrysotile and the chrysotile found in the talcum powder samples typically shows central stop dispersion colors (CSDS) from blues (α) to golden yellows (γ) in 1.550 liquid, and blue to a dark gold in 1.560 liquid. MAS has been reporting this range of CSDS colors for the chrysotile detected in the cosmetic talc samples for almost two years using 1.550 RI liquid. During that time, defendant experts, retained by a number of cosmetic talc manufactures, and have repeatedly testified that MAS' CSDS findings are not appropriate for chrysotile. Therefore, in their opinions, MAS was and has been misidentifying fibrous/platy talc edge or cellulose as chrysotile.

For the Desenex project, MAS used both 1.550 RI fluid and 1.560 RI fluid for analyzing these set of six samples. As discussed by Dr. Gunter, Alan Segrave in their expert reports, and Dr. Su's photo-shop expert report (defense experts in the talcum powder litigation), where they stated that to verify MAS is identifying chrysotile, a higher RI fluid then 1.550 needs to be used. For this PLM analysis of the Desenex powder samples. The results showed by MAS that the primary difference between the two RI liquids is that the measured refractive indices for the 1.560 RI Fluid was slightly closer together for the alpha and gamma directions, which caused the BIR calculations to be more in the LOW range with an overall average of 0.007 (See Table 3), versus 0.009 to 0.013 range typically seen using 1.550 RI fluid.

Additionally, Dr. Gunter, while working as a defense expert for Gold Bond defense council, analyzed samples of RG-144 and SG-210 Calidria chrysotile that MAS provided to him, and confirmed in a recent deposition that "Calidria chrysotile can produce a range of CDSC colors from bluish to golden-yellow in 1.550 liquid."⁸ Dr. Gunter's Calidria chrysotile results are consistent with our laboratories findings, which validates our PLM chrysotile findings in the cosmetic talc samples.

Dr. Gunter's testimony about his Calidria CSDS results is in direct contradiction to his original criticism of the "yellow" dispersion color, as well as Dr. Sanchez and Mr. Seagrave's past testimony on this issue.

⁸ Deposition of Dr. Mickey Gunter, Woods, Jesse & Sarah vs. Kolmar Laboratories Inc. et al. Supreme Court in the State of New York, County of Monroe, #E202000384

It is now my opinion, that when these defense experts were testifying that our Laboratory was misidentifying fibrous talc or talc plates on edge for chrysotile based on the CSDS “yellow color”, as it turns out, the opposite was true, they were the ones misidentifying chrysotile as fibrous talc or talc plates on edge.

ISO-PLM Chrysotile Refractive Index Ranges

As shown in Table 3, the range of measured refractive indexes for the detected chrysotile bundles in the six Desenex powder samples was 1.559-1.569 (parallel) and 1.553 to 1.566 (perpendicular) for the average CSMP method.

Shown in Table 6 are the range of RIs for the 24 chrysotile bundles that were recorded as examples of the chrysotile detected in the six Desenex Powder samples that were prepared by the CSMP method (with HLS).

**Table 6
Range of Parallel and Perpendicular RIs**

Chrysotile Bundle No.	RI Fluid	CSMP PLM (with HLS) Parallel RI	CSMP PLM (with HLS) Perpendicular RI
M71481-001	1.550		
1		Avg. 1.565	Avg. 1.563
2		Avg. 1.563	Avg. 1.554
3		Avg. 1.566	Avg. 1.555
4		1.568	1.560
		Avg. 1.566	Avg. 1.558
M71488-001	1.560		
1		1.569	Avg. 1.558
2		1.569	Avg. 1.560
3		1.568	Avg. 1.560
4		1.568	Avg. 1.560
		Avg. 1.569	Avg. 1.560
M71502-001	1.560		
1		Avg. 1.567	Avg. 1.560
2		1.568	Avg. 1.560
3		1.567	Avg. 1.562
4		Avg. 1.567	Avg. 1.560
		Avg. 1.567	Avg. 1.561
M71503-001	1.560		
1		Avg. 1.568	Avg. 1.561
2		1.566	Avg. 1.561
3		1.567	Avg. 1.562
4		Avg. 1.568	Avg. 1.561
		Avg. 1.567	Avg. 1.561
M71504-001	1.560		
1		1.567	1.557
2		1.566	1.559
3		Avg. 1.564	Avg. 1.559

4		1.566	Avg. 1.559
		Avg. 1.566	Avg. 1.559
M71505-001	1.560		
1		Avg. 1.565	Avg. 1.558
2		Avg. 1.568	Avg. 1.558
3		Avg. 1.567	Avg. 1.563
4		Avg. 1.566	Avg. 1.559
		Avg. 1.567	Avg. 1.560

The ranges shown in Table 6, are consistent with some the RI ranges for chrysotile reported in Table 2-2, shown in EPA’s R93-600 PLM Protocol for the analysis of asbestos containing construction products, that is shown in Table 7 of this report.

Birefringence Measurements

The key optical property to differentiate fibrous talc from chrysotile asbestos, when using the PLM method, is determining the difference in the birefringence (BIR) value between these two elongated minerals. Most PLM analysts will just use the PLM cross-polar condition to visually estimate the magnitude of the BIR (Low, Moderate or High) by the amount of brightness and change in wavelength colors that are observed.

This visual estimate of the amount of birefringence is typically done under cross-polar conditions and is a subjective interpretation by the PLM analyst, therefore, can lead to errors. A more accurate determination of BIR is to calculate the numerical BIR value by simply subtracting the measured perpendicular RI from the measured parallel RI ($n_{\parallel} - n_{\perp}$).

The subtracted BIR results give the analyst a numerical birefringence (BIR) value that is either classified as **Low (<0.01)**, **Moderate (0.01 to 0.05)** and **High (>0.05)**.

Fibrous talc and/or talc plates on edge will have a calculated BIR value that is typically at the high end of Moderate (0.045) to greater than 0.05 which is in the High BIR range. Chrysotile on the other hand, will have BIR values that range from the upper end of the Low range to the lower end of the Moderate range. The average calculated range BIRs, for the detected chrysotile bundles from the six Desenex Powder samples for CSMP PLM method was **0.007**, which falls in the low end of BIR classifications.

The BIR difference between fibrous talc and chrysotile, as demonstrated by MAS, is also verified by the EPA in their 600/R-93/116 PLM methodology document as shown in Table 2-2, page 21.

Table 2-2, “Optical Properties of Asbestos Fibers”, provides four sets of refractive indexes measured from chrysotile bundles that have an overall average BIR of 0.011. This is in good agreement with the overall **MAS BIR avg. of 0.007** for the chrysotile bundles detected in the six talcum powder samples for CSMP sample preparation methods.

Also, the range of BIR values calculated for the chrysotile refractive indexes shown in EPA’s Table

2.2, supports MAS’s PLM data that fibrous talc was not misidentified as chrysotile in the six Desenex Powder samples. The BIR calculations for the EPA’s four sets of chrysotile RI measurements in their Table 2.2 are shown in MAS’s Table 7.

Table 7
EPA-R93 Table 2-2 Chrysotile PLM RI Data
& Birefringence Calculations

Chrysotile RIs Direction Values	BIR Calculations for Chrysotile
1.517-1.493 1.557-1.546	0.024 – 0.011 Avg. 0.018
1.545-1.532 1.556-1.549	0.013-0.007 Avg. 0.010
1.537-1.529 1.567-1.559	0.008-0.008 Avg. 0.008
1.552-1.544 1.561-1.553	0.008-0.008 Avg. 0.008
Range 1.567 to 1.493	Overall Avg. 0.011

In that same table, EPA published a range chrysotile BIR’s of 0.004 to 0.017 (Low to moderate) with an average of 0.011. This BIR range reported by EPA, was from the Maximum and Minimum values obtained from references 2, 11, 12, and 18 located in Section 2.2.

The EPA R93 protocol also provides RI and BIR data for both fibrous talc and Flat cellulose Ribbons that can be found in their Table 2.5. For the RIs of fibrous talc example, EPA reports refractive index 1.600-1.540 with a measured BIR of 0.06, and for cellulose ribbons, the reported EPA RI’s are 1.580-1.530 with a measured BIR of 0.05 as shown in Table 8.

Table 8
EPA-R93: Optical Properties of Selected Fibers
Fibrous Talc & Cellulose Ribbons

Fiber Type	RI Parallel/Perpendicular	BIR Calculations
Fibrous Talc	1.600-1.540	0.060 “High”

In summary, this data demonstrates that the reported chrysotile bundles in the six Desenex Powder container samples analyzed by MAS have both the appropriate range of refractive indexes and BIR demonstrating that chrysotile asbestos was correctly identified in each container sample.

Potential Asbestos Exposure to Desenex Powders:

M71481-001:

The average chrysotile bundle results for PLM analysis shows that one gram of 3.0 oz. (85 g) Desenex antifungal powder contained an average of 234,000 chrysotile bundles per gram of talcum powder.

Multiplying 234,000 chrysotile bundles by 85 grams would equal approximately 20,000,000 chrysotile fibers/bundles, on average, in the one (3.0 oz.) Desenex powder container.

M71488-001, M71503-001 & M71505-001:

The average chrysotile bundle results for PLM analysis for these four Desenex containers shows that one gram of Desenex antifungal body powder contained an average of 282,000 chrysotile bundles per gram of talcum powder. All three of the Desenex containers contain 1.5 oz. (170.1 g) of talcum powder.

Multiplying 282,000 chrysotile bundles by 170.1 grams would equal approximately 48,000,000 chrysotile fibers/bundles, on average, in the one (1.5 oz.) Desenex antifungal powder container.

M71502-001:

The average chrysotile bundle results for PLM analysis shows that one gram of 0.25 oz. (7.1 g) Desenex zincundecate powder contained an average of 312,000 chrysotile bundles per gram of talcum powder.

In addition, sample M71502-001 had detectable amounts of tremolite asbestos at a concentration of 2,790,000 tremolite fiber/bundles per gram. Using the combined average of chrysotile bundles and the addition of tremolite structures would equal approximately 3,000,000 chrysotile/tremolite fiber/bundles per gram of talcum powder.

Multiplying 3,000,000 chrysotile/tremolite bundles by 7.1 grams would equal approximately 22,000,000 chrysotile fibers/bundles, on average, in the one (0.25 oz.) Desenex zincundecate powder container.

M71504-001:

The average chrysotile bundle results for PLM analysis shows that one gram of 6.0 oz. (170.1 g) aerosol spray-on Desenex powder contained an average of 110,000 chrysotile bundles per gram of talcum powder.

Multiplying 110,000 chrysotile bundles by 170.1 grams would equal approximately 19,000,000 chrysotile fibers/bundles, on average, in the one (6.0 oz.) aerosol spray-on Desenex powder container.

Based on these results, it would be my opinion that the application of the talcum powder found in Desenex body powder containers will cause significant exposure, over background, to tremolite and or chrysotile asbestos to individuals, who used Desenex Powder brand talcum powder products for their intended purpose.

All of the opinions that I have stated in this report are held within a reasonable degree of scientific certainty and I reserve the right to supplement this report if any new information becomes available.

Sincerely,

A handwritten signature in black ink, appearing to read 'W. E. Longo', with a long horizontal flourish extending to the right.

William E. Longo, Ph.D.
CEO

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