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SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

ROGER PACKETT, individually and as successor-in-interest to DONNA L. PACKETT, deceased, Plaintiffs, vs. ALLCRAFT JEWELRY SUPPLY CO., et al., Defendants.	Case Nos.: JCCP4674 & BC525735 **DECLARATION OF TERRY M. SPEAR** Date: January 14, 2016 Time: 1:45 p.m. Department: 324, Hon. Emilie H. Elias Complaint Filed: October 25, 2013 Trial Date: February 16, 2016

I, Terry M. Spear, declare as follows:

1. I am over the age of 18 years old and not a party to this action. I reside at 110 South Hauser, Opportunity, Montana. I hold a Ph.D. in industrial hygiene. I am a Professor Emeritus of industrial hygiene at Montana Tech of the University of Montana in Butte, where I formerly taught courses in industrial hygiene and served as the head of the Safety, Health, and Industrial Hygiene Department. A true and correct copy of my current curriculum vitae is included as Appendix A to this Report.

2. I have experience in the field of industrial hygiene pertaining to asbestos and have worked on industrial hygiene issues relating to the W.R. Grace mine near Libby, Montana, for about 19 years. I have extensively studied and provided testimony regarding asbestos

exposure in and around Libby, including during mining activities, railroad activities, and during the use of vermiculite products contaminated with asbestos. I have also testified in cases involving asbestos exposure in Libby at the former vermiculite mine, at the Libby Lumbermill, and at various workplaces in the Libby area. I have visited Libby on many occasions, and have visited the former vermiculite mine and the Libby Lumbermill. I have interviewed scores of former lumber mill and mine workers, as well as citizens of Libby. I have reviewed thousands of records from W.R. Grace, Zonolite, and governmental agencies including State of Montana agency records, records of third parties, relevant industrial hygiene literature, and applicable statutes, regulations and court decisions interpreting statutes and regulations. All of these materials are the type regularly relied upon by professional industrial hygienists in the performance of their profession. I served three years as the Technical Advisor for the Libby Area Technical Advisory Group (LATAG). I am co-author on seven peer-reviewed publications pertaining to Libby amphibole asbestos, and am still involved in research in the Libby area.

3. My opinions as stated herein are based on a more probable than not basis and are a result of my education, training, and experience, as well as my review of the literature and documents cited in this report. A bibliography of references that I have considered and relied on is included as Appendix B to this Report. I reserve the right to alter my opinions based on additional discovery information.

Orton Company sold vermiculite containing Libby Amphibole Asbestos (LA)

4. The Edward Orton Jr. Ceramic Foundation was established in 1932 to continue the operation of the Standard Pyrometric Cone Company for the benefit of the ceramic arts and industry. Orton is the longest continuous manufacturer of pyrometric cones in the world, and ships to over 70 countries worldwide (Exhibit 1, History of Orton). Orton began manufacturing pyrometric cones in 1896. As of 2007, Orton was selling over 12 million cones per year; this number had decreased from its peak sales in the 1970's and 1980's (Exhibit 2, Deposition of Orton's Corporate Designee, Gary Childress, 11/28/07 at 20, 115).

5. Prior to 1963, Orton packaged its pyrometric cones in sawdust (Exhibit 3, Deposition of Orton's Corporate Designee, Dale Fronk, 5/8/08 at 11-12). In 1963, Orton made the decision to cease packing these cones in sawdust due difficulties in obtaining it the quantities Orton required. *Id.* At that time, Orton looked at six to eight alternatives to sawdust, and subsequently decided to begin using vermiculite from Libby, Montana, for its packaging material. *Id.* Other than Libby vermiculite, other alternatives they considered were ground up corncobs, peanut shells, popcorn, and things of that nature. *Id.* In considering these various alternatives, Orton did not perform any research or conduct any inquiry as to the possible health hazards that may have been associated with these materials. *Id.* Further, at no time in its history did Orton perform any testing on the vermiculite packaging material it used (Exhibit 2, Childress deposition 11/28/07 at 95). At no time did Orton provide any warnings to its customers regarding the hazards of the LA vermiculite Orton's Corporate Designee, Gary Childress, testified regarding Orton's purchase, use, and sale of packing materials contained in the boxes of Orton pyrometric cones over the course of the company's history. *Id.* at 116. With regard to Orton's purchases of vermiculite, Orton produced as authentic business records a collection of cancelled checks which provided a perspective as to the dates that Orton obtained vermiculite from each supplier. See Exhibit 2, Childress deposition 11/28/07 at 46-67, Exhibit 4, cancelled checks (originally attached to Childress 11/28/07 as deposition exhibit 3), and Exhibit 5, Declaration of Gary Childress, 11/1/07 (originally attached to Childress 11/28/07 as deposition exhibit 2).

W.R Grace / Zonolite	March 1963 – June 1975
J.P. Austin	September 1975 – June 1979
W.R. Grace / Zonolite	September 1979 – early 1982
J.P. Austin	July 1982 – March 1983

6. In 1983, Orton ceased using vermiculite as its packaging material not for safety reasons, but because the vermiculite "created a lot of dust and [this dust] made the plant dirty." (Exhibit 2, Childress deposition 11/28/07 at 96). At that time, Orton began packaging its cones in styrofoam, a practice which continues to this day (Exhibit 5, Childress declaration).

7. After purchasing, using, and selling vermiculite for eighteen years, on September 2, 1981, Dale Fronk, Ceramic Engineer for Orton, sent the following letter to W.R. Grace & Co., which reads:

> Dear Sirs:
>
> We are required by Federal law to obtain Material Safety Data Sheets for all material we use in the manufacturing of our product, pyrometric cones.
>
> We are currently using and purchasing from your organization Industrial #2 expanded vermiculite. Although this material does not go directly into our product, it is used as a packaging material.
>
> We would appreciate obtaining the above mentioned Material Safety Data Sheets from you along with any other data on Industrial #2 expanded vermiculite which may be valuable to us.

(Exhibit 6, Orton Letter to W.R. Grace & Co., 9.2.81 (originally attached to Childress 11/28/07 as deposition exhibit 5).

8. W.R. Grace & Co. responded to Mr. Fronk's request on September 25, 1981, which reads:

> Dear Mr. Fronk:
>
> This is in response to your recent request for a Material Safety Data Sheet for Industrial Vermiculite #2 which you have been using as packing material.
>
> I am attaching a copy of our M.S.D.S. #Z-140, Industrial Vermiculite, Libby Source- Size #1, #2 & #3.
>
> #3 Expanded Vermiculite is also marketed to consumers as Attic Insulation. When processed for this end-use, it is more intensively screened to remove fines

(vermiculite dust and tremolite) and in some cases, it is treated with a binder of the user to airborne tremolite fiber. You may wish to purchase this to limit dust exposure. It is readily available at most building supply houses.

We have prepared the attached Material Safety Data Sheet in a form that is most meaningful to technically aware industrial end-users who will be aware of the responsibilities placed on them by OSHA Regulations.

It has been our experience, handling significant tonnages of expanded products in our own manufacturing plants, that good industrial hygiene practices will limit the airborne exposures of employees to extremely low levels.

(Exhibit 7, W.R. Grace & Co. letter to Orton, 9.25.81 (originally attached to Childress 11/28/07 as deposition exhibit 6).

9. As referenced in this September 25, 1981 letter, W.R. Grace attached its MSDS for Industrial Vermiculite #2, dated June 10, 1977. This MSDS states:

- Synonyms for this materials include Expanded Libby, Montana Vermiculite;
- Industrial Vermiculite #2 (which Orton used as a packing material) contains naturally occurring contaminant tremolite;
- OSHA defines tremolite as asbestos;
- The physical handling given to expanded Vermiculite can release both airborne fibers and nuisance dust;
- When using Industrial Vermiculite #2, the product should be dampened slightly or one should employ other techniques which control airborne fibers and dust;
- Personal protective equipment should be used to meet exposure limits.

Id.

Libby Montana vermiculite

10. A vermiculite mine located seven miles northeast of Libby, MT (population ~2,700, with nearly 12,000 in the surrounding area) supplied up to 80% of the world's supply of vermiculite from the early 1900s through 1990 (USEPA, 2012a). Vermiculite expands or pops when heated, creating pockets of air that made the material suitable for use in building insulation and as a soil conditioner. Vermiculite from the Libby mine is contaminated with a toxic form of naturally-occurring fibrous and non-asbestiform amphibole in veins throughout the deposit (Pardee and Larsen, 1929). Approximately 30-40% of the amphiboles are asbestiform and include winchite, richterite, tremolite and magnesioriebeckite; differing in their relative proportions of cations (Mg, Ca, Fe, Na, K) (Meeker et al., 2003; Bandli et al., 2003; Gunter et al, 2003; Sanchez et a., 2008; Gunter and Sanchez, 2009). This amphibole mineral mixture is commonly referred to as Libby amphibole (LA).

11. Expanded vermiculite was used in numerous commercial products throughout the 20th century. The largest size or grade 1 was used as a loose-fill insulation (attic and wall cavities) in dwellings and buildings and in refrigerators and furnaces (Keigel, 1940). In addition, expanded vermiculite has been used in potting soils and other horticultural products, and it has also been used as a packaging material and was sold by gardening stores as a gardening product (Potter, 1997, USEPA, 2000).

12. Other uses include an aggregate for insulation plasters, manufacture of fire-resistant, insulating wall-boards and acoustic tile. Very fine sizes were reported to be used as extenders in gold and bronze paints and inks due to their silver to gold colors that were produced upon expansion (Keigel, 1940). Commercial names for expanded vermiculite include Unifil, Porosil, Zonolite®, and Monokote® (Keigel, 1940; Bandli and Gunter, 2006).

Amphibole occurrence in vermiculite

13. An EPA sponsored study (Atkinson et al. 1982) was conducted to determine the amount of asbestiform minerals in vermiculite from three U.S. mining operations; Zonolite Mountain and two South Carolina mines. The estimated content of LA (referred to as tremolite/actinolite) in Libby raw ore at the head feed was reported as 21-26% (by weight) and

in processed ore (beneficiated and sized) was reported as 0.3 to 7 % (by weight) (Atkinson et al. 1982). Amphibole asbestos, reported as temolite/actinolite and anthophyllite, was also detected in South Carolina processed and unprocessed vermiculite, but in "substantially lower" concentrations (<1% by weight) for the fibrous phases (Atkinson et al. 1982). Amandus et al. (1987) reported LA concentrations from internal company (W.R. Grace Co.) sampling in raw ore at the head feed and concentrate as 3.5 – 6.4 % and 0.4 – 1.0 % (by weight), respectively.

14. The amphibole content has also been studied in expanded vermiculite. Moatamed et al. (1986) reported amphibole asbestos concentrations of 0.8 – 2 % and 0.6% for two samples of grade 2 and 3 unexpanded and expanded Libby vermiculite, respectively. A study conducted by the USEPA (2000) revealed asbestos concentrations of 0 to 2.8 % (by weight) in Zonolite brand expanded vermiculite sold in Seattle area retail stores for lawn and garden care use.

15. Bulk vermiculite samples collected from attic spaces as a component of attic insulation disturbance based studies have revealed amphibole asbestos concentrations from non-detect to 10% (Cowan, 1997; USEPA, 2003a; Ewing et al., 2010: Spear et al., 2012). Forty Montana homes (outside of Lincoln County, MT) containing VAI all revealed the presence of LA asbestos in bulk samples (Spear et al., 2012).

Toxicity of Libby Amphibole Asbestos

16. Occupational exposure to LA is associated with significant increases in asbestosis, lung cancer, and pleural cancer compared to the rest of the U.S. population (Sullivan, 2007). In 2009, the U.S. Environmental Protection Agency (EPA) designated the town of Libby, Montana, a public health emergency (USEPA, 2009). This was the first and only time the EPA has made this determination under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

17. One of the earliest publications associating Libby vermiculite with pulmonary changes focused on a worker population from a Marysville, Ohio fertilizer plant that had utilized vermiculite from the Libby mine and South Africa (Lockey et al., 1983). This cohort

became the basis for the RfC published by EPA (2014a). Significant correlations were observed with respiratory symptoms (shortness of breath and pleuritic chest pain) and cumulative fiber exposures (Lockey et al., 1984). Studies focusing on Libby workers soon followed. McDonald et al. (1986) included a cohort of 406 men employed at the mine for at least one year prior to 1963 and followed them until 1983. Compared with white men in the U.S., the cohort experienced excess mortality, with standard mortality ratios (SMRs) of 2.45, 2.55, 2.14 for respiratory cancer, non-malignant respiratory disease (NMRD), and accidents, respectively. Standard mortality ratios are defined as the observed number of cases over expected. The proportional mortality for the four identified mesothelioma deaths was 2.4%. Data collection for a parallel study sponsored by the National Institute for Occupational Safety and Health (NIOSH) was initiated at approximately the same time (Amandus et al. 1987; Amandus and Wheeler, 1987) and included 575 men employed at the mine for a minimum of one year prior to 1970. Similar to the McDonald et al. (1986) study, SMRs were 2.23, 2.43, and 1.44 for respiratory cancer, non-malignant respiratory disease and accidents, respectively (Amandus and Wheeler, 1987). These early occupational-based studies demonstrated strong exposure years/response relationships (McDonald et al., 1986; Amandus and Wheeler, 1987; Antao et al., 2012).

18. McDonald published additional work in 2004 in which he updated epidemiology data for his original 406 man cohort, following them until 1999 (McDonald et al., 2004). The SMRs reported in this update for lung cancer and non-malignant respiratory disease were 2.40 and 3.09, respectively. The proportional mortality for the 12 identified mesothelioma deaths was 4.21%. An all-cause linear model implied a 14% increase in mortality for mine workers exposed occupationally to 100 f/mL/yr and approximately 3.2% increase for the general population exposed to 0.1f/mL for 50 years (McDonald et al., 2004).

19. An additional NIOSH sponsored study included a cohort of 1,672 Libby miners, millers, and processors in 1982 and followed subjects through 2001 (Sullivan, 2007). Compared with U.S. white men, SMRs for asbestosis, lung cancer, and cancer of the pleura

were 165.8, 1.7, and 23.3, respectively, with observed dose related increases in asbestosis and lung cancer. An update of the Sullivan (2007) cohort was published recently (Moolgavkar et al., 2010), revealing similar SMRs to Sullivan. In addition, estimates of relative risk for lung cancer, non-malignant respiratory disease, and total mortality were 1.2, 1.4, and 1.06, respectively, with 95% confidence intervals of [(1.06, 1.17), (1.09, 1.18), and 1.04, 1.08)] (Moolgavkar et al., 2010).

20. One of the latest updates regarding vermiculite worker mortality (Larson et al., 2010), with a cohort of 1862 Libby miners, demonstrated a clear exposure response relationship between cumulative Libby amphibole fiber exposure and asbestosis, lung cancer, mesothelioma, and NMRD mortality. A limitation noted for earlier epidemiology studies evaluating lung cancer SMRs in Libby mine and mill workers was the lack of control for cigarette smoking. Bias analysis revealed that cigarette smoking had minimal impact on the exposure response relationships reported in this study (Larson et al., 2010; reviewed by Antao et al., 2012). An additional conclusion from this study was the association between Libby amphibole fiber exposure and cardiovascular mortality based on a rate ratio of 1.5 with a 95% confidence interval of 1.1 to 2.0 (Larson et al., 2010).

21. A follow-up to the Lockey et al. (1984) Marysville, Ohio fertilizer plant study revealed pleural changes in 28.7% of the cohort (Rohs, et al., 2008). As noted previously, this cohort was the basis for the proposed Libby amphibole RfC. Pleural changes were originally reported in 2.2% of the overall cohort and 8.4% of the highest cumulative fiber exposure group (Lockey et al., 1984). The study is significant in that the cohort was based on exfoliation plant workers outside of Libby, MT, with relatively low cumulative fiber exposure levels compared to those described in the Libby mine and mill worker studies.

22. In addition to epidemiology studies that considered Libby mine and mill workers, research has also included studies evaluating ARD mortality among Libby community members. A cross-section interview and medical testing of 7,307 persons who had lived, worked or played in Libby for at least six months prior to 1991 was conducted in 2000 and 2001

by the Agency for Toxic Substance and Disease Registry (ATSDR) investigators (Peipins et al., 2003). Of the 6,668 participants > 18 years of age who received chest radiographs, pleural abnormalities and interstitial abnormalities were observed in 17.8% and < 1% of the participants, respectively. Participant interviews revealed that the factors most strongly associated with pleural abnormalities were being a former vermiculite mine or mill worker, age, having been a household contact of a former vermiculite mine or mill worker, and being male (Peipins et al., 2003).

23. In 2008, a clinical and exposure summary report for 11 individuals diagnosed with mesothelioma who were not Libby mine or mill employees was published (Whitehouse et al., 2008). All cases were non-occupationally exposed individuals. The authors reported pleural and peritoneal mesothelioma associated with secondary exposure to LA and concluded that exposure most likely resulted from Libby amphibole contamination in the community, the surrounding forested area, and areas in proximity to the Kootenai river and railroad tracks that were used to transport vermiculite concentrate (Whitehouse et al., 2008). The mean LA occupationally related mesothelioma latency period has been reported as 35 years (Case, 2006). The latency period reported for these non-occupational cases was 13-67 years from the first known exposure (Whitehouse et al., 2008).

24. In terms of both occupational and non-occupational mesothelioma cases, current mortality figures indicate one new case per year in Lincoln, County, Montana (McDonald et al., 2004; Case, 2006; Whitehouse et al., 2008). Lincoln County has the third highest age-adjusted mesothelioma death rate in the nation with a rate of 56.1 per million population (NIOSH, 2008).

25. A community study of Libby residents who were children (< 18 years) when the vermiculite mine closed in 1990 revealed a positive association between self-reported respiratory outcomes and certain activities with potential Libby amphibole exposure pathways (Vinikoor et al., 2012). Of the 1,003 study participants, 10.8% reported usually having a cough, 14.5% reported experiencing shortness of breath when walking up a slight hill or hurrying while on level ground, and 5.9% reported having coughed up bloody phlegm in the past year.

Handling vermiculite insulation was positively associated with three of the four outcomes examined compared with never handling vermiculite insulation. No association was found between vermiculite insulation in the home and respiratory symptoms and no association was found between any of the activities and abnormal spirometry (Vinikoor et al., 2012).

26. A community study was conducted in a densely populated urban residential neighborhood in Minneapolis, Minnesota where an expansion facility processed Libby vermiculite ore from 1938 to 1989 (Alexander et al., 2012). In addition to commercial vermiculite products such as Zonolite® insulation and Monokote® fireproofing, the facility produced a waste material reported by the Minnesota Department of Health to contain 10% amphibole asbestos (Alexander et al., 2012). The waste product was piled on the property and offered to the community for use in gardening, driveway fill materials, etc. The prevalence of pleural abnormalities obtained for the 461 participants was 10.8%. The odds ratio associated with direct contact with vermiculite ore waste or ever playing in waste piles and pleural abnormalities was 2.78 (95% CI: 1.26, 6,10) and 2.17 (95% CI: 0.99, 4.78) when adjusted for background exposure. Although this study was conducted outside of Libby, MT, the results suggest that community exposure to Libby vermiculite is associated with measurable effects (Alexander et al., 2012).

27. In addition to pulmonary based ARD, rates of systemic autoimmune diseases (SAID) have been evaluated in the Libby community. A follow-up case-control study was conducted among the participants in the 2000/2001 ATSDR study (Peipins et al, 2003) with cases including subjects that reported one of three (SAIDs) in the initial screening; systemic lupus erythematosus, scleroderma, or rheumatoid arthritis, and controls including subjects in the initial screening that responded negatively to questions regarding SAIDs (Noonan et al., 2006). Odds ratios among former Libby mine and mill workers > 65 years of age of 2.14 (95% CI, 0.9-5.1) for all SAIDs and 3.23 (95% CI, 1.31 7.96) for rheumatoid arthritis, suggest that LA exposure is associated with SAIDs (Noonan et al., 2005). Increasing SAIDs risk estimates were reported for participants with relative increases in reported vermiculite exposure pathways.

28. These epidemiologic studies demonstrate clear and significant increases in asbestos-related disease (ARD), including asbestosis, lung cancer, and mesothelioma among former mill and mine workers. In addition, ARD has been observed in area residents with no direct occupational exposures. The most common health outcome among Libby residents and others with low lifetime cumulative fiber exposure levels are pleural changes.

29. EPA (2003a) Disturbed Vermiculite Study: EPA collected data from personal and stationary air monitors in the immediate vicinity of people actively engaged in disturbing vermiculite insulation. This scenario was intended to assess exposures that might be experienced either by homeowners who engaged in activities in unfinished attic areas, or for contractors who might come into contact with vermiculite during repair or remodeling activities. These data demonstrated that active disturbance of vermiculite results in very high concentrations of fibers as measured by both phase-contrast microscopy (PCM) and transmission electron microscopy (TEM) phase-contrast microscopy equivalents (PCME). The highest airborne concentration of 3.3 total asbestos fibers per cubic centimeter (f/cc) by transmission electron microscopy (TEM) occurred during the simulation with Zonolite Vermiculite. In Phase 2, levels of airborne asbestos fibers were detected during seven simulations conducted in an artificial containment system. Bulk analysis of the Zonolite product indicated that it contained trace amounts of asbestos fibers (PLM: <1% tremolite; TEM: <0.1% tremolite/actinolite). Airborne asbestos fibers were detected in approximately half of the total air samples collected (total from all personal and stationary air samples combined). The maximum airborne concentration of 4.3 total actinolite f/cc by TEM occurred during the first simulation with dry vermiculite (EPA, (2003a).

30. In another study, activity-based air and surface sampling was conducted in three homes to evaluate amphibole asbestos exposures during specific activities in attics containing vermiculite attic insulation (VAI) (Ewing et al., 2010). Personal and area air sampling revealed significant concentrations of airborne amphibole asbestos above background concentrations

when VAI was disturbed. The highest personal and area concentrations were observed when VAI was moved aside with a dry sweeping method.

31. According to the Colorado Department of Public Health And Environment, Hazardous Materials and Waste Management Division, several studies using a variety of approaches, including the state of the science, for the release of asbestos fibers from significantly <1% asbestos in soil/debris demonstrated that all types of asbestos fibers can be released into the air or breathing zone during soil disturbing activities resulting in unacceptable risk that is significantly above acceptable cancer risk level of 1 in a million at 0.000004 ($4X10^{-6}$) f/cc (EPA IRIS), and even above the OSHA limit of 0.1 f/cc, in some cases. (See http://www.cdphe.state.co.us/hm/asbestos/111021riskppt.pdf .)

32. Addison (1988, 1995), Soil > .001% Asbestos Can Generate Excess of 0.1 f/ml: The best information about the levels of asbestos content in soils likely to cause a health risk comes from the Addison et al. (1988) experiments where it was recommended "that soils containing more than 0.001% asbestos are regarded as being capable of generating airborne fibre concentrations in excess of 0.1 f ml-1 (the OSHA workplace standard) and that precautions to protect the workforce by wetting the soil, providing respiratory protection etc., are taken". Addison (1995) stated:

> It would be necessary therefore to take action specifically to control for the asbestos emissions if soils containing higher levels than 0.001% asbestos were to be handled without significant health risks. Asbestos, if present in vermiculite, is likely to behave in a similar fashion; with the asbestos loosely dispersed and readily available for release into the air. Even relatively gentle handling of the vermiculite would abrade the friable asbestos, splitting fiber bundles, and adding to the released fibers. Thus, even though the carcinogens legislation may impose only a 0.1% limit for packaging and labeling, the vermiculite industries would be advised to establish their own target limit of 0.001% for amphibole asbestos. Most current supplies of vermiculite could still meet this standard

Addison et al. (1988) conducted experiments to evaluate the release of dispersed asbestos fibers from soils. Addison et al. (1988) showed that the most important factor controlling airborne fiber concentrations in the experiments with dry loose aggregate mixtures was the bulk asbestos content and that, irrespective of fiber type or soil type, high airborne fiber concentrations over 200 times the current OSHA Permissible Exposure Limit (PEL) for asbestos can be generated from soil containing just 1% asbestos. Addison also showed that soil with concentrations of 0.1%, or 1/10 the EPA action level, were capable of producing airborne asbestos levels in excess of 8 times the current OSHA PEL for asbestos. Addison (1988) also reported,

> There was a progressive reduction in airborne fibre concentrations at a given dust concentration with reducing amounts of asbestos in the mixtures, but this reduction was not proportionate to the reduction in asbestos content below 0.1%. With 0.1%, and often 0.01%, of asbestos in soils, the 0.5 f/ml-1 Control Limit for chrysotile and the 0.2 f/ml-1 Control Limit for crocidolite and amosite could be exceeded while respirable dust concentrations were below 5 mg/m-3, the nuisance dust OEL. Similarly, it is apparent that the clearance limit of 0.01 f/ml-1 could be exceeded with any of the 0.01% and 0.001% asbestos mixtures if respirable dust concentrations approached the nuisance dust OEL.

Early Knowledge of Libby Amphibole (LA) Asbestos Hazards

As of 1956, the State of Montana was aware of the presence of asbestos at the Zonolite mine and mill operation (MT State Report 8/13/1956). In a confidential report to Zonolite in 1956, the State warned of the toxicity of asbestos by stating that "the asbestos dust in the [vermiculite] dust in in the air is of considerable toxicity and is a factor in reducing the dustiness of the plant." The report expanded the asbestos toxicity discussion by describing the potential for respiratory fibrosis that is associated with asbestos exposure. "The asbestos fiber group...stimulate the formation of a diffuse fibrosis" (Report and Cover letter from Wake to Bleich, 9/21/56). In a report to Zonolite in 1959, the State further described the toxicity of asbestos by stating that, "According to Ellman (1933), Inhalation of asbestos dust must be

expected sooner or later to produce pulmonary fibrosis, depending upon (a) length of exposure and (b) nature and concentration of the dust. Pulmonary asbestosis, once established, is a progressive disease with a bad prognosis; its treatment can only be symptomatic...." In this report, the State provided results of the 13 dust samples collected in the six floors of the dry mill. In addition to particle analysis to determine concentrations for comparison to the nuisance dust standard, the concentration of asbestos was also determined and reported (Report and Cover letter from Wake to Bleich, 1/12/1959). In a report to Zonolite in 1962, the State noted that dust concentrations had increased from the two previous evaluations (1956 and 1958 (reported in 1959)). The results of 20 dust samples were reported. Analyses were compared to exposure limits for mica, rather than nuisance dust, and asbestos. "The asbestos content of the dust is the controlling factor for making the maximum allowable concentration 5 mppcf." (Report and Cover letter from Wake to Bleich, 4/19/1962). In a report to Zonolite in 1963, the State reported that there was "as serious dust concentration, particularly in view of the quantity of asbestos known to be in the mixture" (Report and Cover letter from Wake to Bleich, 4/11/1963). The State sent additional communication to Zonolite in July of 1963, regarding the results of six vermiculite samples that were analyzed to determine the tremolite/actinolite content. The percentage of asbestos, reported as tremolite-actinolite ranged from 6.2 to 22.5 (Letter from Wake to Bleich, 7/3/1963). In a report to Zonolite in 1964, the State discussed the results of six dust samples conducted in the dry mill. In this report, the State specifically warned that asbestos exposure has the potential to cause cancer, including mesothelioma, citing work by Selikoff as well as British and South African investigators. The report further added that, "while the above situation does not apply specifically to the operations of your plant, the asbestos content of the material with which you are working appears to provide some serious potential for the development of disease if not properly controlled" (Report and Cover letter from Wake to Bleich, 5/11/1964).

In the early 1960s, asbestosis began appearing on the death reports of former vermiculite mine workers. Glenn Taylor, a worker at Zonolite was diagnosed with asbestosis in 1959

(Discharge Summary of Glenn Taylor, 3/20/1959). Glen Taylor died of asbestosis in 1961 (Death Certificate – Glenn Taylor, 9/15/1961). The State also had notice of deaths due to asbestos related pulmonary issues or corpulmonale (lung related heart failure) of Zonolite employees: Charles Wagner, a mechanic, in 1961 (Death Certificate of Charles Michael Wagner, 10/14/1961); Albert Barney, a drymill worker in 1964 (Death Certificate of Albert Burr Barney, 1/12/1964), and; Walter McQueen, a miner, in 1966 (Death Certificate of Walter Leo McQueen, 10/30/1966).

CONCLUSION

33. Based on the information presented in this report, and my research and knowledge of the issues relating to Libby Amphibole Asbestos (LA) and asbestos in general, as well as my education, training, and experience in the field of industrial hygiene, it is my opinion that the vermiculite packing material that Orton obtained from W.R. Grace and used as packing material in the boxes of Orton Pyrometric Cones sold in the early 1970s, 1980, and 1981, was contaminated with LA. Furthermore, activities involving the disturbance of that vermiculite, including rummaging through the vermiculite to locate and extract the cones and cleaning up any vermiculite that spilled out of the box during that process, would have in all probability dispersed respirable amphibole asbestos fibers into the air and into the breathing zone of the person or persons performing those activities.

I declare under penalty of perjury, under the laws of the State of Montana and the United States, that the foregoing is true and correct.

Dated this 21st day of December, 2015, in Opportunity, Montana.

Terry Spear

Terry Spear