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May 22, 2014

Robert E. Thackston
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Re: Jeff Kovar (for Lyle Kovar, deceased) vs. Reichhold, Inc., et al.

Dear Mr. Thackston:

In the above referenced matter, your office has requested that I assess the alleged asbestos exposure of Mr. Lyle Kovar that may be related to the alleged handling or potential exposure to asbestos-containing products, with particular emphasis on exposures, if any, from products manufactured by Reichhold, Inc. This report summarizes the information reviewed and my opinions with respect to the plaintiffs' potential exposure to asbestos, from an industrial hygiene perspective.

PROFESSIONAL QUALIFICATIONS AND EXPERIENCE

I am a board-certified Industrial Hygienist with over 35 years of experience in the field of occupational health and safety. My work experience has been focused on the prevention of adverse health effects and injuries in the workplace, throughout a wide range of industrial and other occupational environments. I have extensive field experience in the practice of evaluating potential health hazards in the workplace and in conducting the appropriate measurements and evaluations of various substances, including asbestos, to identify potential health and safety risks. My experience has also included the design and implementation of exposure controls to reduce or eliminate workplace hazards, including engineering, work practice, and administrative controls and the use of personal protective equipment. A copy of my resume is attached to this report.

GENERAL OPINIONS THAT I MAY OFFER

In addition to any case-specific opinions that I may offer, I am familiar with and have knowledge regarding the state of the art with respect to asbestos in the field of industrial hygiene, and the general evolution of knowledge regarding the effects of asbestos exposure and on control practices during the period relevant to this case. I am familiar with the development and use of methodologies for identifying and measuring asbestos in air and in products, and the process of setting threshold limit values (TLVs), Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs), and other standards for asbestos exposure control.

I am familiar with and have knowledge regarding the general relationship between scientific knowledge and the development of public policy and governmental standards related to asbestos. I am familiar with or have knowledge regarding exposure assessment methodologies, including those used to reconstruct and estimate workplace exposures.

BASIS OF OPINIONS

I was provided with the following materials to review in this matter:

1. Plaintiff's Answers to Defendants' First Joint Set of Interrogatories
2. Plaintiff's Supplemental Answers to Rog. # 74
3. Plaintiff's Supplemental Answers re: Exhibit 1
4. Plaintiff's Expert - Report of Dr. Hyer
5. Plaintiff's Expert - Report of Dr. Abraham
6. Plaintiff's Expert – Report of Dr. Frank
7. Lyle Kovar's Certificate of Death
8. Square D Co-Worker Deposition Transcript of Gary Emanuel
9. Square D Co-worker Deposition Transcript of Ronald Anderson
10. Square D Co-worker Deposition Transcript of Ronald Ogden
11. Deposition transcripts of Square D employees in prior litigation, including but not limited to the following:
    - Deposition of Robert Barbaglia, dated Sept. 7, 2005
    - Deposition of Dennis Albaugh, dated August 16, 2007
    - Deposition of L.D. Lammey, dated Jan. 29, 2003 and August 16, 2007
    - Deposition of Raymond Attwood dated March 5, 2009
    - Deposition of Lyle Noeller, dated May 19, 2006, Aug. 17, 2007 and Feb. 17, 2010
    - Deposition of Sandra Brown, dated August 9, 2011
    - Deposition of Donald Carter, dated Oct. 3, 2011
    - Deposition of Beverly Clinton, Dated Oct. 4, 2011
    - Deposition of Joe Alan Hartman, dated Nov. 29, 2011
    - Deposition of William Vosdingh, dated Nov. 30, 2011
12. Deposition of John Walsh, for Union Carbide, dated Nov. 18, 2009 and Exhibits
13. <u>Reichhold Documents</u>:
    - Defendant Reichhold, Inc.'s Answers to Plaintiff's First Interrogatories, Jeff Kovar vs. Union Carbide Corp., et al.
    - Defendant Reichhold, Inc.'s Responses to Plaintiff's First Request for Production of Documents, Jeff Kovar v. Union Carbide Corp., et al.
    - Reichhold Standard Production Documents – RI-00001 – RI 000706
    - Deposition of Tom Madden, taken in the DE Trial Cluster Cases on Feb. 14, 2012, and Exhibits

- Deposition of Tom Madden, Smith v. Reichhold, Inc., et al., (CA) dated 7/14/11
- Deposition of Anthony Neibert, dated 9/26/13 with Exhibits from Kreske (IL) matter
- Reichhold Product Information Sheets for for RCI 25310, 25346 and 25346AF

14. Durez Documents:
    - Occidental Chemical, Durez Division, Responses to Interrogatories, San Francisco, 4/9/08 and 7/13/09
    - Durez Records 000001-Durez Records 000074
    - Affidavit of Authenticity of Durez/Occidental records, Durez-Records 00001-000074, signed by Teresa Jo Settle, 9/10/12
    - Occidental Chemical Corporation, Letter to Square D Company, Re: Asbestos Content of Durez Materials, dated 2/21/1991
    - Durez Raw Materials Purchase Records
    - Charles R. Rexford v. Asbestos Corporation, et al., Answers to Interrogatories, Sept. 2, 2003
15. North American Asbestos Corporation Documents:
    - Sales Securements 1959-1963 and Correspondence, 1/21/77
    - NAAC Records 00001-NAAC Records 00007
    - Stipulation of Authenticity of NAAC Records 00001-00007
16. Plenco Documents:
    - Plastics Engineering Company, Sheboygan, WI, Industrial Hygiene Survey of Asbestos Dust and Aniline in Various Plant Operations, Oct. 3, 1972
    - Industrial Hygiene Survey of Asbestos Dust and Phenol in Various Plant Operations, August 1, 1972
    - Industrial Hygiene Survey of Asbestos Dust in Phenolic Resin Compounding, June 5, 1972
17. GE Documents:
    - Asbestos Exposure Evaluation, Plaintiff's Exhibit GE-775, Asbestos Exposure Evaluation, Jan. 4, 1973

To formulate my opinions, I have relied on my review of these documents, the general scientific literature covering aspects of industrial hygiene, toxicology, epidemiology, and engineering data relevant to the subject review, and my background and experience in the practice of industrial hygiene.

PLAINTIFFS' OCCUPATIONAL AND EXPOSURE HISTORY

Lyle Kovar was born on August 2, 1939. According to Interrogatory Responses, Mr. Kovar did not serve in the military. Also according to Interrogatory Responses, Mr. Kovar worked at the Square D Plant in Cedar Rapids, Iowa between 1958 and 1978 and also at the Square D Columbia, Missouri plant between 1978 and 1986. Interrogatory

Responses indicate that Mr. Kovar was diagnosed with mesothelioma in August of 2012 and passed away in October of 2012.

The Cedar Rapids Square D plant primarily manufactured various types of circuit breakers and other electrical equipment parts, according to employee testimony. In the fabrication side of the plant, compression and transfer presses were used to mold phenolic resins into various parts of electrical components. The assembly area of the plant included work stations for assembly of the final products. The assembly area also had equipment for riveting parts, calibration equipment and packing equipment.

Three co-worker depositions were provided for this review which described the work that Mr. Kovar performed over the course of his employment with Square D. Ronald Ogden testified that Mr. Kovar started at the Cedar Rapids plant in 1958 when they were both working as "move men" who were responsible for moving parts and products around the plant. Mr. Ogden testified that Mr. Kovar worked as a move man for about 2 years on the assembly side of the plant. He testified that Mr. Kovar became a lead man in 1960 and a foreman in 1963, still working on the assembly side of the plant. He testified that Mr. Kovar would sometimes go into various parts of the plant to get the materials that he needed to do his work, which could include visits to the storeroom, brazing area and the molding area. Mr. Ogden stated that Mr. Kovar worked in the assembly side of the plant between 1958 and 1971. He noted that there was a wall separating the assembly area from the fabrication side, and another wall that separated the molding department from the rest of the fabrication area. Mr. Ogden stated that Mr. Kovar would occasionally have to go into the molding area to get materials to bring back to the assembly area, but noted he would only spend about 5-10 minutes at a time in the molding area during those visits.

Mr. Emanuel also testified that Mr. Kovar worked on the assembly side of the plant. Mr. Emanuel testified that Mr. Kovar became the general foreman of the fabrication area in the late 1960's. Mr. Emanuel described the work that was done in the fabrication area, noting that machine operators ran the presses and the job of loading the molding compound into the hoppers on the presses was the job of the setup men. The job of hand filing flash from the parts when it was needed was done by the machine operators. Other parts were put in the Tumblast or the Multi-table for removing flash.

Mr. Emanuel testified that it was not Mr. Kovar's job to operate the molding presses, although he noted that he had seen Mr. Kovar run a half-dozen parts on a manual press just to see how it was working at the Cedar Rapids plant. He stated that he had never seen Mr. Kovar cut open bags of molding compound and pour it into the hopper on the presses, either at Cedar Rapids or Columbia. Mr. Emanuel did not see Mr. Kovar use the rasp for flash removal on molded parts, and he stated that Mr. Kovar was not involved in the operation of the Tumblast or Multi-table equipment. Mr. Ogden provided similar testimony that Mr. Kovar did not load molding compound into hoppers, run the presses, do any filing of flash on finished parts or run the Tumblast or wheel abrader machine at the Columbia plant. Mr. Ogden did not see Mr. Kovar work with the materials that were used to make the arc stacks.

Mr. Emanuel testified that he and Mr. Kovar worked together at Cedar Rapids until December of 1977, when they were both moved to a new plant that was being built in Columbia, Missouri. They first reported to a training facility in January of 1978. During the time that Mr. Kovar spent at the training facility, Mr. Anderson testified that he did observe Mr. Kovar training employees on the molding presses. During the training, Mr. Anderson testified that he observed Mr. Kovar dumping material into the hoppers on the presses and operating the presses. He testified that he had seen Mr. Kovar use the rasp to file flashing on the molded product as part of the training. Mr. Anderson testified that the Columbia plant was completed and went into operation around September of 1978.

Mr. Emanuel stated that Mr. Kovar was the plant superintendent in charge of production at the new Columbia plant. Mr. Emanuel testified that Mr. Kovar spent less time on the plant floor at the Columbia plant than he had at the Cedar Rapids facility. Mr. Anderson testified that Mr. Kovar had an enclosed office out in the plant, although he continued to spend some time on the floor talking to employees and making sure the operations were running well. Mr. Kovar became the plant manager at the Columbia plant sometime in the early 1980's. He was promoted again at some point to a vice-president position, and had reportedly left the Columbia plant by 1986.

In questioning of the three co-workers regarding molding compounds that were used at Cedar Rapids and at the Columbia Square D plants, they generally recalled Plenco as the primary or highest volume product that was used. Mr. Emanuel recalled the use of Plenco 509, Rogers 468, Durez and Reichhold molding compounds, although he said that Reichhold was used the least of the four brands and he did not recall any specific Reichhold product. He stated that he recalled seeing "very few" bags of Reichhold product, and said if he did, it was in the 1970's. He stated that he thought they only used Reichhold for special products, although he did not know what product it may have been used for or on what machine it may have been used.

Mr. Anderson testified that he recalled the use of Plenco, Durez and Reichhold molding compounds at the training center. He stated that they used Plenco 509 and Durez 486 at the Columbia plant. He testified that they used Reichhold products, saying he was familiar with Reichhold 25310 and 25346. He said they used the Reichhold products in much smaller amounts than Plenco and Durez, as the Reichhold product was only used to make handles and some component parts inside of the breakers. He testified that he believed that they were all asbestos-containing products at one time. It should be noted that the Reichhold product 25346 was produced as both an asbestos-containing product and a non-asbestos (asbestos-free or "AF") product. Mr. Anderson noted that the Plenco 509 product was changed in 1983 or 1984 and became asbestos-free. He stated that in later years, they also used Cyanamid and Rogers molding compounds.

Mr. Ogden also stated that Plenco was the primary molding compound that they used at Cedar Rapids, noting that Plenco 509 was the largest volume product. He stated that they also used a large volume of Durez, stating that they used a 40,000-pound load each week of both products, and sometimes two loads a week of the Plenco product. He stated that they also used Reichhold molding compounds, but in much smaller volumes, estimated at about 2,000 to 4,000 pounds a month.

Employees recalled various forms of the different molding compounds that were used at Square D. Mr. Emanuel recalled that the Durez molding compound was not granular but instead was "spongy". Mr. Ogden testified that the Plenco 509 was like "meal or flour". He testified that the Durez product was also a flour-type of material. He noted that the Rogers product was black pellets that had whitish specks in it that he believed to be asbestos.

Mr. Emanuel and Mr. Ogden described seeing dust when the bags of molding compounds were cut open and dumped into the hoppers, and said the molding area was a dusty work space. Mr. Ogden also testified that it was dusty in the area when the Spaulding coils and strips were run through the punch press to make the arc shields. He recalled seeing some air sampling at one time that he believed was probably done to evaluate the dust particles. Mr. Anderson testified that ventilation was installed on the molding machines in the 1980's. He also testified that a vacuum system was added to load the hoppers on the molding machines at the Columbia plant sometime between 1982 and 1984, which eliminated the need to dump bags into the hoppers. However, he noted that dust was still observed coming from the drum when that system was being used.

Mr. Emanuel did not recall any training that involved how to safely handle asbestos. He did not recall seeing any warnings about asbestos and he did not recall the use of masks at the Square D plants. Mr. Anderson did not recall seeing anyone using masks or respirators at the Columbia plant, nor could he recall any posted asbestos warnings at the plant. Mr. Ogden did not recall seeing the use of respirators at the Cedar Rapids plant. Mr. Ogden stated that he did not recall ever seeing a warning on any of the bags or packages of product about the potential hazards of asbestos, and he did not recall seeing or reading any MSDS. He stated that it was "common knowledge" that the molding compounds contained asbestos.

DISCUSSION

As noted, Mr. Kovar worked at the Square D Cedar Rapids and Columbia manufacturing plants between the years of 1958 and 1986. Mr. Kovar began working in the assembly area of the plant at Cedar Rapids and moved through various levels of management at the Cedar Rapids and Columbia facilities. Mr. Kovar was not directly involved with handling molding compounds or running the molding equipment, but he had various job responsibilities over the years that involved spending limited amounts of time in all areas of the plant operations.

Phenolic Molding Compounds – Overview
Phenolic molding compounds are complex mixtures of materials that are specifically blended to meet unique product specifications for making a wide range of reinforced plastic products. Components of phenolic molding compounds include catalysts, colorants, resins, lubricants and fillers in various concentrations to impart specific product characteristics such as surface hardness, machinability or unique properties required for electrical components such as thermal resistance and dielectric strength. Asbestos was used as a component in some phenolic resin compounds for its properties that include chemical and fire resistance and product strength. Various types of fillers were also used in the blending of phenolic molding compounds, including wood or other natural fibers, walnut shells, mica and fibrous glass.[1]

Molding Compounds used at Square D
Employees of Square D have identified that various molding compounds were used at the Square D Cedar Rapids and Columbia plants, including compounds manufactured by Durez, Plenco, GE, Hass, Rogers, Union Carbide and Reichhold. One of the Square D employees testified that the plant used as many as 50 different molding compounds.

Many of the employees who had been previously deposed in Square D litigation did not recall seeing a Reichhold product at Square D, as reflected in the testimony of Raymond Attwood, Donald Carter, Sandra Brown, Beverly Clinton, Joe Alan Hartman and Dennis Albaugh. Lyle Noeller testified that he recalled seeing bags of a Reichhold product at the Cedar Rapids facility in 1957 or 1958. Mr. Noeller testified that he was not involved in the process when the Reichhold product was brought into the plant at that time, stating that he was in shipping and receiving at the time. Mr. Noeller reportedly helped to unload presses that were sent from another Square D facility. He testified that he believed that the Reichhold powder came with the presses, and he had helped to unload the presses and move them into the plant.

Mr. William Vosdingh provided detailed testimony regarding his work at the Square D Cedar Rapids plant. Mr. Vosdingh began working at Square D in 1955 and became involved in the molding process in the latter part of the 1950's. Mr. Vosdingh continued working at Square D until 1973, when he left for one year. Mr. Vosdingh returned to Square D in 1974, and continued working at the plant until the time of his deposition in 2011. Between 1974 and the early 2000's, Mr. Vosdingh was the molding process engineer at Square D, where he was specifically involved in the selection of materials that were used in the manufacture of the molded products produced at the facility. Mr. Vosdingh testified that Square D used molding materials manufactured by Union Carbide, Durez, Plenco and Rogers. When asked if Reichhold was also a supplier, Mr. Vosdingh testified that they had sampled the Reichhold product on several different parts, but he stated that Reichhold was never a major supplier to the Square D facility. Mr. Vosdingh testified that he did not know in which products the Reichhold material was used.

As previously discussed, Mr. Emanuel, Mr. Anderson and Mr. Ogden testified that Reichhold molding compounds were used at the Square D Cedar Rapids and Columbia plants, but to a much lesser degree than several of the other brands of molding compounds.

It is noted that Mr. Barbaglia testified that the Square D Cedar Rapids plant also used raw asbestos fiber in their molding operations at one time, stating that he believed the raw asbestos fiber they used was chrysotile asbestos and that it was used for its electrical insulation properties.

<u>Characteristics of Square D "Powder-Type" Molding Compounds</u>

Employees at the Square D Cedar Rapids plant testified that various types of molding compounds were used at the facility, many of which were specifically described as "dusty" and which contributed to dusty conditions in the plant. They reported dust from molding compounds that were described as "powder" when they were dumping the material and noted that many people in the plant complained about the dust. Employees testified that they had to constantly dust off their machinery and sweep up the work area using a vacuum and push broom. Employees testified that their machines would sometimes be covered in dust and that it would combine with the grease on the machinery, making it very difficult to clean the equipment.

Mr. Lammey testified that the "powder" that they used at the Cedar Rapids plant created dust and that it was "terrible" at times when they dumped the bags into the 50-gallon barrels. He testified that a change was made in the dumping operation in 1974 after OSHA visited the plant. He testified that that the barrels were then required to have tops on them and to fill from the ground, not from above. Mr. Lammey specifically described the Durez product as a "fiber" material. He noted that the product had fibers in it which he called "floaters" because they would float around in the air. Mr. Lammey and others noted that there were floor fans in the molding department, but he said that the fans only served to move the dust around. Employees testified that some of the products were granular, but others were more "powder-like" than granular.

Asbestos was likely a component in some molding compounds that were used at the Square D Cedar Rapids and Columbia manufacturing plants. Chrysotile asbestos was used most typically in phenolic molding compounds, although amphibole asbestos was used to a lesser extent.[2,3,4]

According to the testimony, Durez molding compounds were used at the Square D facilities. As noted, one of the employees at the Square D Cedar Rapids plant specifically observed that the Durez product that they used was a "fiber" material which contained "floaters" that he observed floating around in the air. Durez was one of the four primary products used at the Square D Cedar Rapids plant, as noted by the plant molding process engineer. Durez molding compounds were reportedly sold in nodular, flake and granular form. Some of the Durez molding compounds contained asbestos, ranging between 3 and 51% asbestos. Durez molding compounds may have contained both chrysotile and crocidolite asbestos.[5] Other molding compound manufacturers may also have used crocidolite asbestos in some molding compounds.

Plenco phenolic resin molding compounds were also used at Square D in the molding operations. Information regarding Plenco phenolic resin manufacturing operations indicates that asbestos was a component of some of their molding compounds that were produced in the 1970's.[6]

The use and handling of "powder" type of molding compounds that contained asbestos has been demonstrated to result in the release of dust into the workroom atmosphere. In these types of products, the asbestos is not effectively bound into the matrix of the material. Air sampling conducted in facilities manufacturing an asbestos-containing molding compound has demonstrated airborne concentrations of asbestos ranging between 4.0 and 11.8 f/cc during the compression and packing of a Plenco asbestos-containing molding compound into drums that was described as a "fluffy" product by the industrial hygienist who performed the air sampling.[7] The exposure concentration of 11.8 f/cc was measured during a 17-minute sample, which would have exceeded the OSHA asbestos exposure ceiling limit in effect at the time of the survey and would be well in excess of the current short term exposure limit for airborne asbestos fibers. These high airborne levels of asbestos were measured where "good" local exhaust ventilation was reportedly being used on the production process.

It would be desirable to have industrial hygiene monitoring data to characterize the exposures associated with the handling of the powder-type molding compounds described at Square D. However, it is believed that the exposure levels reported in the handling of the Plenco molding compound suggest that potential employee exposure to asbestos from the handling of powder-type molding compounds that contained asbestos at Square D may have been substantial.

Bystander exposures that may have been encountered by other personnel working in the vicinity of dusty work tasks are generally estimated to be between 10 and 25% of the primary worker exposure level, dependent upon the distance from the source, general area ventilation, dust settling, etc. Exposure levels less than 1% may be present at a distance of 30 feet or more from the measured source of the exposure.[8,9,10,11,12]

From an industrial hygiene perspective, it is believed that the asbestos exposure associated with the use of powder-type molding compounds that likely contained asbestos and, most significantly, the use of molding compounds that contained crocidolite asbestos may have been sufficient to create an increased risk of asbestos-related lung disease for workers at Square D, depending on the proximity and duration of their work in areas of the plant where dusty work conditions were noted.

Characteristics of Reichhold Molding Compounds

As noted, employees testified that various molding compounds were used at Square D, and they described the use of "powder" products that were very dusty during use and handling. Some employees indicated that Reichhold was one of the many brands of molding compounds that were used at the facilities. If Reichhold phenolic molding compounds were used at Square D and if some of those compounds contained asbestos, the potential for employee exposure to airborne asbestos from the use of those products would be negligible.

Reichhold manufactured phenolic molding compounds at its Carteret, New Jersey manufacturing facility beginning in 1964.[13] The Reichhold phenolic molding compounds that were manufactured at the Carteret New Jersey manufacturing plant were clearly a different type of molding compound, as compared to the dusty "powder" type of products described by employees at Square D.

The conventional process for the manufacturing of phenolic molding compounds was well known to be an extremely dusty process, which was also recognized to be a fire and explosion risk. Lack of uniformity in the product also created problems in downstream molding operations.

Recognizing the problems associated with the conventional manufacturing process of phenolic resin molding compounds, research was underway in the late 1950's to solve these problems. When an English manufacturer of molding material was able to solve these problems using an extrusion process that produced a high quality product that was dust-free and demonstrated improved product uniformity, Reichhold investigated the extrusion process and decided to enter the phenolic molding product business with the construction of a manufacturing plant in Carteret, New Jersey. By the early 1960's, the plant was producing phenolic molding compounds that were described as completely dust-free, offering clear advantages for customers using these products, reducing dust exposure to employees and improved shop cleanliness. The extruded product offered advantages in molding operations due to the uniformity and consistency of the product.[14] Customer experience with Reichhold phenolic molding compounds used in molding operations demonstrated one of the advantages in using the dust-free Reichhold product in their ability to run clear or light-colored products on presses that were right next to a machine using Reichhold phenolic molding compounds. These customers noted that they could not do that with other molding compounds, because dust released from those other compounds would cause color contamination of the clear or light-colored product.[15] Clearly, the Reichhold extruded phenolic molding compound in a dust-free, granular form was a different product as compared to the dusty "powder" products that were being used at Square D.

The description of the dust-free Reichhold product is consistent with my own experience conducting industrial hygiene surveys in the mid-1970's in numerous thermoset molding operations that used a granular or pelletized dust-free molding compound. The use of the dust-free granular or pelletized molding compounds did not create dusty plant conditions that were similar to the conditions described by employees of Square D.

From 1964 until 1980 or 1981, some of the molding compounds produced by Reichhold at the Carteret plant contained short fiber chrysotile asbestos or "asbestos floats". RCI Cost Standard documents indicate asbestos concentrations ranging from less than 2% up to greater than 40% chrysotile asbestos, although more than half of the asbestos-containing formulations contained 10% or less asbestos fiber.

Reichhold had a pro-active program in place to provide product labeling and Material Safety Data Sheets for their products. Product warning labels were placed on asbestos-containing phenolic molding compounds in 1972. Material Safety Data Sheets (MSDS) were produced and distributed for Reichhold molding compounds, including asbestos-containing compounds, long before the passage of the OSHA hazard communication standard that required the development and distribution of MSDS to customers of products that contained potentially hazardous materials. Reichhold began phasing out the use of chrysotile asbestos in its products in 1974, and believes that it completed the phase-out of asbestos by the end of 1980 or early 1981.

As noted, the extruded phenolic molding compounds produced by Reichhold are a polymerized, granular or pelletized product where the asbestos and other particulate components are bound in the matrix of the extruded resin product. Therefore, asbestos fibers and other particulates are not released during handling of the extruded resin product. When the molding material is heated and compressed by molding machines at facilities making a molded product like Square D, asbestos fibers and other fibrous or particulate components of the resin system are completely encapsulated in the finished molded product.

While industrial hygiene data is not available to characterize the potential airborne concentrations of airborne asbestos fibers at Square D during the use of phenolic molding compounds that may be similar to those manufactured by Reichhold, an understanding of likely exposure levels can be gained from an industrial hygiene survey identified as a GE Asbestos Exposure Evaluation published in December of 1972.[16] This study measured the asbestos exposure of employees in the molding operations, where it was noted that the molding compounds containing asbestos were the "de-dusted granular type" which release "less fibers than dusty compounds". The reported concentrations of airborne asbestos in the molding room operations were well below the applicable time-weighted average exposure limit at the time of the study as well as the current OSHA 8-hour time-weighted average exposure limit for asbestos, with a mean exposure level of 0.02 f/cc. Short-term or "peak" exposure level measurements demonstrated exposure levels that were well below the applicable OSHA short-term exposure limit, and consistently well below the current OSHA short-term or excursion asbestos exposure limit.

These data provide clear evidence that molding operations involving the use of a granular or pelletized molding compound like the Reichhold phenolic molding compounds do not release airborne asbestos fibers into the workroom air in concentrations in excess of current or historic occupational exposure limits for asbestos fiber during molding operations when asbestos-containing molding compounds are used. The use or handling of these products does not create an increased risk of asbestos-related lung disease.

Phenolic Resin Molded Products - Industrial Hygiene Considerations

From an industrial hygiene perspective, typical work activities involving a product like the Reichhold extruded phenolic molding material or finished molded products made from phenolic resins would not be expected to lead to airborne concentrations of asbestos fibers and would not be considered a significant source of potential exposure to asbestos. Asbestos presents a respiratory health hazard when fibers become airborne and can be inhaled. Dr. William Nicholson of the Mount Sinai Group noted in 1972 that the risk associated with an asbestos-containing product is dependent on "whether or not the asbestos is firmly "locked-in" the product with a binder, saturant, coating or bonding agent such that normal handling, application and use do not release it."[17] As described by Lewis Cralley from the Bureau of Occupational Safety and Health in 1971, when asbestos fibers are firmly bound in a product, the need for precautionary measures to control exposure would not be expected unless the product is altered such that "the fibers may become uncoated, free and released through friction, destruction, deterioration, and the like."[18] This understanding of asbestos-containing materials and potential for fiber release has been the basis for the determination of appropriate asbestos control practices that are used and mandated by regulation today. Under the OSHA regulations initially published in June of 1972 through the current regulations that exist today, no asbestos warning label is required on a product when asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonable foreseeable use, handling, storage, disposal or transportation, no asbestos fiber concentrations in excess of the exposure limits will be released.[19]

With respect to asbestos-containing thermosetting resins, the chemical reactions that occur when the resin is cured cannot be reversed. The final cured resin product is a hard plastic material and the components of the resin system are permanently embedded in the finished product, including the various fillers, hardeners, coloring agents, etc. Subsequent processing of the fully cured resin product would not be expected to release respirable dust, even if the plastic was cut, drilled or sanded in subsequent handling. The potential for release of asbestos fibers in airborne dust from disturbance of thermoset resin materials was explored in 1975 by Faulring, et al.[20] Dust samples generated by using a power grinder on fully cured thermoset resin products containing chrysotile asbestos found that the dust released from the grinding was typically non-fibrous and encapsulated in the resin matrix.

This understanding of the nature of thermoset resin products was further reflected in 1982 in a Draft Final Report prepared for the U.S. Environmental Protection Agency, titled "Analysis of Fiber Release from Certain Asbestos Products" by GCA Corporation.[21] In a section reviewing the use of asbestos-reinforced plastics, the report notes that, once these products are fabricated and ready for use, the potential for asbestos fiber release is highly unlikely. It is further noted that a great deal of energy needs to be applied to the plastic product in order to release any amount of asbestos fiber. In describing the use of these materials in electronics and automotive parts, the authors opine that there is no significant exposure hazard from the asbestos content of the products during typical handling and replacement activities.

While these assumptions have generally guided the industrial hygiene understanding of the potential risk associated with the use or handling of these asbestos-reinforced plastics, additional study has been conducted to demonstrate that potentially harmful levels of asbestos are not released even when these products are subjected to destructive actions that include sawing, sanding or drilling. A study published in 2005 by Mowat, et al.,[22] demonstrates the range of exposure levels that may be encountered during these work activities involving a phenolic resin product containing 31% chrysotile asbestos. In this study, each work activity was performed using power tools continuously for 30 minutes with no local exhaust ventilation in a test chamber, clearly representing a worst-case example that would not likely be encountered in the typical work environment during the handling of these products. Drilling operations resulting in total fiber measurements of 0.03 f/cc measured by PCM (Phase Contrast Microscopy) and asbestos fiber concentrations of <0.01 f/cc, using TEM (Transmission Electron Microscopy) analysis in accordance with NIOSH Method 7402. An estimated 8-hour time-weighted average for work that involved drilling for two hours and sweep cleaning of the work area for another hour over the course of an 8-hour workday resulted in an average fiber level (measured by PCM) of 0.006 f/cc. The calculated "worst-case scenario" that involved sawing, sanding, drilling and clean-up conducted continuously over the course of an 8-hour workday resulted in a maximum exposure level of 0.08 f/cc and an average exposure level of 0.06 f/cc. This exposure profile demonstrates that workers would be exposed to levels of airborne asbestos fibers that would be well below current and historic occupational exposure limits when performing a significant amount of destructive work on an asbestos-reinforced resin product. Furthermore, if destructive handling of these asbestos-reinforced resin materials such as drilling, sanding and sawing does not result in exposure levels that represent an increased risk of asbestos-related disease, it is clear that normal handling activities will pose no exposure or associated health risk.

If Reichhold molding compounds were used at Square D manufacturing plants, according to the testimony, and if some of those compounds did contain chrysotile asbestos, finishing operations on molded products would not be expected to release asbestos fibers at concentrations that would exceed current workplace health standards for asbestos or that would contribute to an increased risk of asbestos-related lung disease.

Amphibole v. Chrysotile Asbestos Exposure

There is widespread agreement in the scientific community that amphibole asbestos fibers, including amosite and crocidolite, have far greater potency for causing respiratory disease than chrysotile asbestos fibers. In the 2003 Report prepared for the EPA[23], it was reported that the potency of amphibole fibers is at least two orders of magnitude greater than that of chrysotile asbestos in causing mesothelioma. Other researchers suggest a 500-fold difference in potency.[24] In the Final Draft of the Technical Support document for a Protocol to Assess Asbestos-Related Risk prepared for the U.S. Environmental

Protection Agency, the potency of chrysotile was reported to be only 0.0013 times that for amphibole.[25] In further analysis published by Berman and Crump in 2008, the potency differential between chrysotile and amphibole asbestos for increasing the risk of mesothelioma was similarly defined.[26] Also in 2008, Berman and Crump reported their finding that human epidemiological statistics do not support the hypothesis that chrysotile increases the risk of mesothelioma, stating that "for mesothelioma, the hypothesis that chrysotile and amphibole are equally potent was strongly rejected by every metric and the hypothesis that (pure) chrysotile is non-potent for mesothelioma was not rejected by any metric."[27] It is reasonable to conclude that current scientific consensus finds the amphibole forms of asbestos to be the causative agents in an asbestos-related mesothelioma.

Evolution of Knowledge regarding Asbestos Health Risk and Regulations

It is important to understand the evolution of knowledge regarding the health risks associated with exposure to asbestos, as the knowledge that we have today has developed slowly over a period of many years. An association between asbestos exposure and asbestos-related lung disease was identified by Merewether and Price as early as 1930, based upon studies of asbestos textile workers in England where dust levels were found to be extremely high and cases of asbestosis were detected in the worker population.[28] At that time, visible dust clouds in the air were observed to represent dangerous concentrations of dust. In 1938, Dreessen studied the incidence of asbestosis in workers in the textile industry in the United States, where dust concentrations were also very high.[29] It was believed at the time that if dust concentrations could be kept below 5 mppcf (million particles per cubic foot), that workers would not be at risk of asbestos-related lung disease.

In 1946, the ACGIH (American Conference of Governmental Industrial Hygienists) adopted the first compilation of exposure limits for chemical substances. These exposure limits were established to identify concentrations of substances to which workers could be exposed for extended periods of time without incurring injury or occupational disease. The occupational exposure limit for asbestos dust at that time was 5 mppcf, similar to the exposure limit for other pneumoconiosis-producing dusts.[30]

In the years following the early studies that identified the risk of asbestosis from exposure to asbestos, there were evolving case reports of a link between lung cancer and asbestos exposure. An epidemiology study of British asbestos workers by Doll in 1955 provided evidence of a cancer risk in workers with very high exposure to asbestos fibers in manufacturing operations.[31] However, it was not until the late 1960's and early 1970's when consensus began to emerge in the scientific community regarding the cause and effect relationship of asbestos and lung cancer.

The risk of mesothelioma associated with exposure to asbestos was also evolving in the 1960's, beginning with the work of Wagner who identified cases of mesothelioma in workers exposed to crocidolite asbestos in South African mining operations.[32] Additional study by various researchers continued through the mid-1960's, at which time there remained a lack of scientific consensus on the relationship between asbestos exposure and mesothelioma. At the 1964 conference in New York on the Biologic Effects of Asbestos, the delegation of experts in attendance at the conference recommended that further investigation be made of mesothelial tumors of the pleura and peritoneum to establish any association with asbestos and other factors.[33]

While knowledge was available in the published literature as early as the 1930's regarding the risk of asbestosis in worker populations as previously noted, the focus at that time was on heavily exposed workers in the asbestos textile industry and manufacturing operations. It was not until the mid-1960's that the potential exposure and risk associated with commercial and industrial insulation work and other users of products that contained asbestos began to be considered, studied and published in the literature, beginning most notably with the work directed by Dr. Irving Selikoff at Mt. Sinai Hospital in New York.[34, 35]

During the 1964 Conference on the Biological Effects of Asbestos, the focus was beginning to move from asbestos exposure associated primarily with very high exposures associated with industries such as textile manufacturing toward other workers that may also be potentially exposed to asbestos, such as asbestos cement workers, shingle and tile manufacturers, brake lining manufacturing, construction workers, etc.[36] The conference specifically called for extending studies of morbidity and mortality to populations of workers that had not yet been widely investigated.

Regulatory action in the early 1970's by the U.S. Department of Labor Occupational Safety and Health Administration prompted additional study of potential asbestos exposure in industries that used or handled other types of asbestos-containing products.[37] Prior to 1970, most of the information evolving on asbestos exposure and the associated health risks was taking place in research institutions and in the medical literature. Additionally, there were a very limited number of trained industrial hygiene professionals available to provide service to employers prior to that time. In 1971, OSHA promulgated occupational health standards, including a permissible exposure limit for asbestos of 12 f/cc. Following the implementation of these and more detailed asbestos exposure control regulations by OSHA in the years that followed, the potential for risk associated with exposure to asbestos in general industrial operations became more widely understood within the industrial community. Additional study regarding the potential for exposure, the effectiveness of exposure controls and the evidence of disease risk over subsequent years led to ongoing enhancements in exposure control practices to those that exist today.

Employer Obligations for Employee Safety and Health Protection

It should be noted that the Square D facilities were obligated to comply with federal and state regulations to ensure that their employees were protected from potential workplace hazards. The responsibility for worker safety and health protection in the United States is clearly placed upon the employer. Occupational safety and health rules define employer obligations for worker safety and health. Federal and state agencies provide information