

BEFORE THE INDUSTRIAL ACCIDENT BOARD
OF THE STATE OF DELAWARE

THE ESTATE OF WILLIAM PEARSON,)
)
 Claimant,)
)
 v.) Hearing No. 1379165
)
STAR BUILDING SERVICES,)
)
 Employer.)

DECISION ON PETITION TO DETERMINE COMPENSATION DUE

Pursuant to due notice of time and place of hearing served on all parties in interest, the above-stated cause, by stipulation of the parties, came before a Workers' Compensation Hearing Officer on August 8, 2014, in a Hearing Room of the Board, in New Castle County, Delaware.

PRESENT:

SUSAN D. MACK
Workers' Compensation Hearing Officer

APPEARANCES:

Elizabeth Lewis, Esquire, Attorney for the Claimant

Cassandra F. Roberts, Esquire, Attorney for Employer

NATURE AND STAGE OF THE PROCEEDINGS

The Estate of William Pearson (“Claimant”) alleges that William Pearson (deceased) developed multiple myeloma as a result of his occupational exposure to chemicals while he was employed with Star Building Services (“Employer”). A Petition to Determine Compensation Due was filed on January 24, 2012 by William Pearson and pursued by the Estate after his death on October 22, 2012. The date of injury specified on the petition is August 31, 2011. Claimant seeks acknowledgement of an occupational disease and payment of related medical bills related to the illness. The Employer denies the multiple myeloma was causally related to any exposure at work.

The parties stipulated that the case could be heard and decided by a Workers’ Compensation Hearing Officer, in accordance with title 19, section 2301B(a)(4) of the *Delaware Code*. When hearing a case by stipulation, the Hearing Officer stands in the position of the Industrial Accident Board. *See* DEL. CODE ANN. tit. 19, § 2301B. A hearing was held on the pending petition on August 8, 2014.

SUMMARY OF THE EVIDENCE

The joint stipulation of facts sets forth the following: William Pearson was employed by Star Building Services consistently from 1985 until August 2011. Pearson developed and died from multiple myeloma. His job responsibilities included floor stripping, waxing, and carpet cleaning, although the parties do not agreed as to the extent to which these duties comprised his job. The sole issue is whether Pearson’s death from multiple myeloma was due to a workplace exposure or due to other non-work-related factors such as gender, race, and the co-morbid diagnosis of Hepatitis C.

Richard Collins testified for Claimant that he is 56 years old and worked for Star Building Services for about 15 years. He left the job in 2007. He started as a parttime cleaner and then worked in warehouse delivery and later as a supervisor and manager. For about ten years, he stripped and waxed floors as part of his employment. Collins worked with William Pearson after moving to the warehouse job. Star Building Services cleans buildings and also provides supplies to the buildings such as chemicals and paper towels. The regular floor crew was overwhelmed with work, so Collins and Pearson began cleaning and stripping and waxing floors on the weekends in addition to their warehouse jobs. Collins testified that they did this most weekends for at least seven years, though he and Pearson did not always work together. Each floor job on the weekend could take 8 to 12 hours. Larger floors were typically stripped and waxed on the weekends when businesses were closed. Smaller areas were done on evenings during the week. Collins also cleaned carpets with Claimant, using dry foam, powder, and an extraction machine. Carpet cleaning was performed for clients on a regular basis, typically quarterly. Collins estimated that he worked about 60 hours on Monday through Friday and an additional 8 hours on the weekend. He believes Claimant worked a similar number of hours per week.

Collins described the stripping and waxing process. Three gallons of water were mixed with two gallons of stripper in a bucket. This solution was spread over the floor with a mop and allowed to sit for five to ten minutes, then a stripper machine was run over the floor. Next, a wet vacuum picked up the liquid and the floor was rinsed with a clean mop. Fans were used to dry the floor. Last, three coats of wax were applied to the floor. He estimated that one five-gallon container of stripper was used for a 1,000 square foot floor. Several workers were required to strip and wax the floors. The buffing and stripping took about two hours for 1,000 sq ft and the

waxing could take 1.5 hours. He estimated that the floor dried for about 15 to 20 minutes between stripping and waxing. Each crew member would do a little of everything during the process and switched jobs. Collins and Pearson considered themselves equals on the crew and worked together. Collins named a number of locations where he worked with Pearson. Collins testified that they never received safety instructions on using the chemicals. He recalled using a respirator on one job because the chemicals were strong. Pearson maintained a file with MSDS sheets in case a client requested that copies be provided. Collins helped to file the MSDS sheets.

Collins recalled using GTO spot cleaner, GTO Carpet Plus, Scott's Liquid Gold furniture polish, Pledge Lemon aerosol, Never Dull Magic wadding polish for stainless steel, and Behold furniture polish.

On cross-examination, Collins confirmed that Scott's Liquid Gold, Lemon Pledge, and Behold were all furniture polishes. Collins could not recall using Triple S stainless steel wipes. He did use chemically treated cloths to clean furniture. The Never Dull product was used to clean stainless steel.

On re-direct, Collins testified that they used dry powder or a foam called Franklin 3-in-1 carpet shampoo to clean carpets. They also used "Jack Hammer" aerosol on the baseboards and corners of tile floors before stripping and waxing them. This product helped to break down wax in those areas. The complete stripping and waxing process took 8 to 12 hours. They used the Jack Hammer as sections of floor were cleaned.

Under questioning by the Board, Collins testified that he rarely used personal protective equipment. He used a respirator when cleaning some marble tile in a restroom. It took 8 to 12 hours to strip and wax a 1,000 sq ft area. On re-direct, Collins testified that he worked on floors

with Pearson almost every weekend. About half the time they were cleaning carpets. Carpet cleaning took place year round, but only on a quarterly basis for each customer.

Dr. Omowunmi Y.O. Osinubi testified that she is a medical doctor who specializes in occupational and environmental medicine. She has taken classes in occupational and environmental toxicology and also taught a course in the subject at Rutgers University. She currently works for the VA at the War-related Illness and Injury Study Center in New Jersey, where she has treated patients exposed to petrochemical agents. She has also evaluated patients who had multiple myeloma. She offered her *curriculum vitae* into evidence. (Claimant's Exhibit 1) Dr. Osinubi conducted an evaluation of William Pearson by telephone on June 23, 2012. Both Mr. Pearson and his wife participated in the one and a half hour interview. Dr. Osinubi also reviewed various medical records prior to her telephone interview of Mr. Pearson. She subsequently reviewed the MSDS sheets provided by the Employer and Mr. Pearson's death certificate, as well as the reports from Dr. Tsai and Dr. Greenberg. Ideally, Dr. Osinubi likes to perform an examination of the patient in person, but this was not possible for Pearson, because he was in the terminal phase of his disease. The telephone interview was conducted to evaluate Pearson's work exposure to chemicals. Dr. Osinubi found Mr. Pearson to be credible in the history he provided, because it was consistent throughout her interview of Pearson, with the medical records she reviewed, and with the interview summary of Richard Collins. The medical records documented that Pearson worked for 8 to 12 hours per day for a cleaning company and worked on his hands and knees at times. An Excel spreadsheet provided by the Employer that documented his work hours from 2006 to 2011 showed that Mr. Pearson worked from 60 to 70 hours per week during that time period. The medical records showed that Claimant developed multiple myeloma.

In Dr. Osinubi's opinion, William Pearson developed multiple myeloma and died at a much younger age than would be expected as a result of his work for Star Building Services. She opined that his substantial exposure to petrochemicals at work accelerated the multiple myeloma and made it more virulent, resulting in his death at a younger age than he would have without the chemical exposure. She acknowledged that Pearson also had risk factors that predisposed him to the development of multiple myeloma, specifically that he was male, black, and had Hepatitis C. Nonetheless, she insisted that the combination of his exposure to petrochemicals at work and the other risk factors caused Pearson to die from multiple myeloma earlier than would otherwise have been expected. Dr. Osinubi explained that the exact cause of multiple myeloma is unknown, so she must look at contributing risk factors to determine causation in Pearson's individual case. Most people who manifest multiple myeloma are between 45 and 70 years of age, but most commonly people manifest the disease between 65 and 70 years of age. Dr. Osinubi listed prior radiation exposure, HIV, and a family history of a bone marrow cancer as other risk factors for multiple myeloma that Pearson did not have. She also testified that petrochemicals are notorious for causing cancers of the bone marrow, and multiple myeloma fell into this category. For example, benzene is a class 1 carcinogen that doubles the risk of multiple myeloma. Trichloroethane (TCA) was associated with at least thirteen times the risk of multiple myeloma in one study and increased risk in other studies. Toluene has been associated with five times the risk of multiple myeloma in studies. Dr. Osinubi opined that the combination of chemical exposures plus other factors and Pearson's individual susceptibility made him succumb to multiple myeloma at a much younger age that otherwise would have been expected.

Dr. Osinubi took the following occupational history from Pearson. He worked in a janitorial position with Star beginning in 1984 or 1985 and later moved to a job in the warehouse, where he performed a variety of duties, including warehouse work, maintenance, cleaning offices, and stripping and waxing floors. Over time, he did more and more floor work at night. These jobs were performed indoors, sometimes with closed windows and poor ventilation. Chemicals for stripping were mixed in a five-gallon bucket. Floor areas up to 3,000 square feet were cleaned. Fans were used to dry the floors. Pearson reported that the stripping and waxing chemicals had very strong odors and often caused him to have headaches, dizziness, nausea, and light-headedness. He would leave the area for fresh air when this happened, then return back to the work area when he felt better. Dr. Osinubi felt these symptoms were consistent with exposure to petrochemicals. He did not wear personal protective equipment. Sometimes he received safety training for a chemical, but other times he did not. He did receive MSDS sheets for the various chemical products. Pearson would complain to his doctor of a cough two or three times a year and he was treated for asthma, but the doctor never investigated a possible occupational cause for the asthma. In 2011, Pearson saw a doctor for symptoms that included back pain, a chronic cough, chronic bronchitis, and swelling feet. Ultimately, he was diagnosed in August 2011 with multiple myeloma and a tumor on his spine.

Dr. Osinubi reviewed 262 MSDS sheets provided by the Employer. A number of products caught her eye. She identified several petrochemicals contained in products on the MSDS sheets that were of concern to her. She concluded that Pearson was more likely than not exposed to petrochemical agents based on the MSDSs in the binders and Pearson's description of his cleaning work. The chemicals of concern she identified on the MSDSs were petrochemicals that included perchloroethylene (Perc), toluene, aliphatic hydrocarbons, naphtha, distillate spirits,

1,1,1-trichloroethane (TCA), hexane, and other hydrocarbons. Dr. Osinubi considered the duration and quantity/dose of exposure in rendering her opinion. Dr. Osinubi estimated that Pearson spent about 408 hours per year doing the stripping and waxing task for Star between 2006 and 2011; extrapolated over a 27 year period, this could equate to five to seven years of total exposure during this time to the stripping and waxing chemicals, based on the data provided by Star. She further noted that Pearson spent additional time cleaning carpets. Everyone in the floor crew would be exposed to the chemicals, because they were working in an enclosed environment and the chemicals were airborne. The fans could also mix the air so that everyone in the crew was exposed to the same amount of chemical. It was difficult to quantitate Pearson's exposure at this late date, so Dr. Osinubi stated that Pearson was more likely than not exposed to petrochemicals as part of his job. Pearson did not provide any history of chemical exposure in previous jobs he had held or through hobbies. Dr. Osinubi concluded after reviewing Pearson's history that his exposure at work showed up as a substantial contributing factor to his development of multiple myeloma, in combination with his other risk factors of age, race, and diagnosis with Hepatitis C.

Dr. Osinubi testified that multiple myeloma is an uncommon cancer, making up one percent of all cancers and two percent of all cancer deaths. She considered it a rare cancer for people to develop at a younger age than expected, so she would look for an environmental cause. Pearson's oncologist had told him that his chemical exposure caused his cancer. Dr. Osinubi testified that there is no safe level of exposure to a carcinogen, and the higher the exposure, the greater the likelihood of developing the cancer. She used the *Bradford Hill* criteria to conclude that Pearson's multiple myeloma was caused by chemical exposure. She explained that *Bradford Hill* was an accepted framework to determine the likelihood an exposure caused a disease. The

first criterion is strength of association, or the probability someone exposed to a chemical will develop the disease, expressed in terms of relative risk or odds ratios. Dr. Osinubi reviewed scientific literature that showed an increased risk of developing multiple myeloma from the exposure to certain chemicals that appeared on the Star MSDS sheets. The *Infante* study indicated a 2.1 relative risk of multiple myeloma from exposure to benzene, as quoted by the IARC¹ monograph on Benzene. Various studies showed 1.8 times (*Gold et al*), 13 times (*Blair et al*), or even 56 times (*Spirtas*) relative risk from exposure to TCA; Dr. Osinubi felt these studies showed a strong association between TCA and multiple myeloma. Toluene presented an 8 times greater risk, and Perc presented a 17 times greater risk, based a study she reviewed (*Spirtas* study). Dr. Osinubi insisted these studies showed a substantial risk and association between the chemicals and multiple myeloma. The consistency of the association (second *Bradford Hill* criterion) across different study populations and countries made the causal association stronger. Studies of cleaning workers had also found a higher risk of developing multiple myeloma. Dr. Osinubi opined that Pearson's exposure to benzene could not be compared to everyday exposure in the environment, because Pearson worked with the chemicals in an enclosed room. Also, many of the chemicals he worked with are also contaminated with benzene, though the contamination is not documented in the MSDS sheets. As to the specificity of chemical exposure to a particular disease (third *Bradford Hill* criterion), Dr. Osinubi testified that most exposures to petrochemicals caused multiple diseases. Dr. Osinubi next considered the fourth *Bradford Hill* criterion, temporality, which she considered to be an important factor here. Pearson was exposed to petrochemicals at least 10 to 15 years before his diagnosis with multiple myeloma, which fit with the latency period for multiple myeloma of 10 to 15 years. The fifth *Bradford Hill* criterion was biological gradient, or a dose-response relationship. Dr. Osinubi

¹ IARC is the abbreviation for International Agency for Research on Cancer.

cited studies showing a higher risk of developing multiple myeloma with more exposure to Perc and TCA. Dr. Osinubi also testified that there was a plausible mechanism for benzene and related petrochemicals to cause cancer, thereby meeting the *Bradford Hill* criterion for plausibility. As documented in the IARC monograph, the scientific literature has described a toxicological pathway for benzene to damage bone marrow, and cancers associated with benzene exposure include multiple myeloma and other bone marrow cancers. Dr. Osinubi further testified that the IARC monograph concluded that the entirety of the literature showed benzene to be carcinogenic in humans, with the literature showing a positive association between benzene and leukemia, lymphoma, multiple myeloma, and non-Hodgkin's lymphoma. This met the *Bradford Hill* criterion for coherence. The eighth *Bradford Hill* criterion, experimental or intervention effect if an exposure was removed, could not be tested with carcinogenic substances, according to Dr. Osinubi. The last *Bradford Hill* criterion was analogy, and this criterion was met because chemicals similar to benzene caused cancer in the same way. Dr. Osinubi testified that chemicals related to benzene could cause cancer by damaging DNA and depressing the immune system. In addition, she asserted that mixed exposures to carcinogens make a person more vulnerable to developing multiple myeloma more quickly. Dr. Osinubi further testified that petrochemical exposure magnified the risk of developing multiple myeloma when combined with Pearson's other risk factors. Being male increases risk less than two times, and Hepatitis C increases the risk by at least two times. Dr. Osinubi insisted that all nine criteria from *Bradford-Hill* did not need to be met to establish causation. If evidence weighs in favor of causation, then action should be taken. She further noted that all scientific work is by its nature incomplete and subject to modification. She opined that the exposure to petrochemicals in

cleaning agents was a material and substantial causal factor in Pearson's development of multiple myeloma at the age of 53.

Claimant admitted the following documents into evidence: The IARC monograph on benzene (Claimant's Exhibit 2), the *Gold* study (Claimant's Exhibit 3), the *Blair* study (Claimant's Exhibit 4), the *Spirtas* study (Claimant's Exhibit 5), Summary of Exposure Work Hours (Claimant's Exhibit 6), and the MSDS summary and sheets (Claimant's Exhibit 7).

On cross-examination, Dr. Osinubi agreed that African Americans are two times more likely to develop multiple myeloma than the general population. The disease is the most common of the hematological malignancies among blacks, and blacks have the highest incidence of the cancer compared to other racial groups. Dr. Osinubi agreed that Hepatitis C is a recognized risk factor associated with multiple myeloma. She agreed that the *Morgan* study was negative for a significant association between benzene and multiple myeloma, but she pointed out that there were studies that were positive for a causative association also. The *Constantini* study showed a biologically plausible association between benzene and multiple myeloma. It also recognized that benzene is fairly ubiquitous in the environment and not confined to the work environment. Dr. Osinubi noted that the *Becker* epidemiological study of multiple myeloma referred to *Constantini* as evidence of an association between benzene and other petrochemical agents and multiple myeloma, though the *Becker* article also concluded that the studies it reviewed did not provide evidence of a major role for benzene and other petrochemical agents in multiple myeloma etiology. Dr. Osinubi insisted that the *Becker* article relied on studies that were based on small populations and the article concluded that more research was needed. *Constantini* did show an increase in multiple myeloma with exposure to benzene, according to Dr. Osinubi. She acknowledged that the *Gold* study recognized some limitations to its

conclusion that there is an association between multiple myeloma and TCA. *Gold* was a case control study suggesting that increased exposure to chlorinated solvents led to increased multiple myeloma, but the result was limited by low participation of control subjects. *Gold* recommended larger studies be undertaken. Dr. Osinubi confirmed that the *Collins* study stated that multiple myeloma is the second most common form of hematological malignancy in the Western world, and 98 percent of patients are 40 years of age and older.

Dr. Osinubi read a summary of the interview with Richard Collins; she did not interview him herself. Collins did not mention specific cleaning products. Pearson identified generally that he worked with stripping and waxing products and a variety of chemicals, but he did not identify specific cleaning products to Dr. Osinubi. He reported feeling ill while working with the chemicals, but he continued to work 60 to 70 hours per week. Dr. Osinubi stated that the peak age for developing multiple myeloma is 65 to 70 years old, and this is the age range she put into her report. She did not recall stating that 45 to 70 was the median age for developing the disease. Dr. Osinubi reviewed 262 MSDS sheets, but she does not know which products Pearson worked with and when. Pearson told her he worked with a variety of chemicals, and they changed over the course of his career. She used the best information available to her about what Pearson was exposed to during his work with Star, which consisted of the MSDS sheets provided by Star. She asked the Employer to provide a list of the chemicals Pearson worked with, and the Employer provided the 262 MSDS sheets. She had no way of knowing the frequency of exposure to specific chemicals in the MSDS sheets. The Employer did not provide a job description for Pearson, even though she requested one. The primary route of exposure for Pearson would have been inhalation, and secondarily contact exposure. Dr. Osinubi agreed that many of the chemicals were present in household cleaning products, but she explained that we do

not use these cleaning products 10 to 12 hours per day for 27 years, so it was not appropriate to compare Pearson's exposure to everyday household cleaning. The Employer provided Dr. Osinubi with the number of hours Pearson spent doing various activities at work, and this showed Pearson had spent a substantial number of hours cleaning. Dr. Osinubi has to rely on what the Employer provides to conduct her analysis and had to assume Pearson worked with the chemicals the Employer identified. She felt the onus was on the Employer to provide information on specific exposures, and she noted that there may be other products that Claimant was exposed to that were not included in the MSDS sheets. Dr. Osinubi identified thirteen products of concern out of the 262 MSDSs provided by the Employer. Both Dr. Osinubi and Dr. Tsai included Clausen cleaner, SSS Stainless Steel cleaner swipes, Behold, Endust, and Scott's liquid gold on their lists.

Dr. Osinubi testified that inhalation and dermal contact are the exposure routes for petrochemical solvents. Inhalation is the primary exposure route. Dr. Osinubi agreed that Pearson suffered from a severely compromised and depressed immune system prior to developing multiple myeloma, as shown by his intermittent episodes of pancytopenia. She testified that pancytopenia can be caused by benzene and petrochemical exposure or by Hepatitis C. Dr. Osinubi also testified that the *Bradford Hill* criteria are used to establish causation from epidemiological studies and other scientific studies, whereas industrial hygienists look at duration and dose of exposure.

On re-direct, Dr. Osinubi testified that the American Cancer Society places the peak incidence of multiple myeloma at 65 to 70 years old. Pearson has three risk factors for multiple myeloma. His Hepatitis C was asymptomatic. He saw an infectious disease specialist in 2010 or 2011 regarding the disease. Dr. Osinubi described the *Blair* study as coming out ten years after

the *Spartas* study and providing an even stronger association between TCA and multiple myeloma. In a benzene study, *Infante et al*, IARC cites a 2.13 risk for a positive association between benzene exposure and multiple myeloma. Dr. Osinubi reviewed medical records that indicated Pearson stripped and waxed floors, worked on his hands and knees, and performed other services. She also looked at Star Building Services' website to find out what types of facilities they clean. Dr. Osinubi and Dr. Tsai separately compiled lists of ten to twelve products used at Star that they believe were of concern. Dr. Osinubi insisted that stripping and waxing floors and cleaning carpets would expose Claimant to petrochemicals.

Su-Jung (Candace) Tsai, Sc.D., testified by deposition for Claimant as an expert in industrial hygiene. (Claimant's Exhibit 8) Dr. Tsai holds bachelor's and master's degrees in chemical engineering and a doctorate in cleaner production and occupational hygiene. She currently serves as an assistant professor of Occupational Health and Industrial Hygiene at Purdue University and performs research on airborne toxic substance exposures and nanotechnology-related exposures. She previously worked in the petrochemical industry and, as a process engineer, had to deal with emissions associated with benzene and other chemicals. Dr. Tsai produced a report dated July 2, 2014 regarding Mr. Pearson's occupational exposure to solvents during his employment with Star Building Services. Mr. Pearson was already deceased at the time, so Dr. Tsai prepared her report based on a review of MSDS sheets, Dr. Osinubi's report, and the interview report of Richard Collins. Dr. Osinubi's report included facts collected in her interview of Mr. Pearson.

Dr. Tsai learned that Mr. Pearson worked for Star Building Services from 1984 or 1985 through 2011. He worked with different types of chemical material used for floor stripping and waxing, for carpet cleaning, and for surface cleaning. He continuously worked in a room using

those chemicals, and he mixed the solvent and applied it to the surfaces. This work was performed inside commercial buildings such as offices, stores, and medical facilities. Dr. Tsai believed that Claimant had physical contact with petrochemical solvents in the course of his work. He manually mixed chemicals and solvents in a five-gallon bucket before applying the solvent to the floor for waxing or surface cleaning. A number of the chemicals contained petroleum products and other toxic chemicals, according to the MSDS information Dr. Tsai reviewed. Dr. Tsai prepared a list of these products of concern. (Deposition Exh. 2) Dr. Tsai also learned that Pearson did not wear a respirator or other personal protective equipment. He would therefore be exposed to the chemicals when they evaporated. Dr. Tsai stated that benzene was contained in the petroleum products. When Mr. Pearson would apply the petroleum products to the floor or any surface for cleaning, he would be exposed to the benzene in the very short distance from the surface to his breathing zone when the benzene evaporated. In Pearson's case, the major pathway of exposure was inhalation, because Pearson did not describe touching the chemicals or having a large spill on his skin. Pearson would be directly exposed during the entire time he stayed in the room where the chemical solvent was applied.

The products listed in the table prepared by Dr. Tsai all contain A1 or A2 carcinogens. A chemical is classified as an A1 carcinogen when there is strong evidence it causes human cancer and it is considered a confirmed human carcinogen. Class A2 chemicals are considered probable human carcinogens. Dr. Tsai reviewed the MSDS content for these products listed. The A2 carcinogens in SSS-Spot solvent are toluene, perchloroethane, perchloroethylene (PERC), and 1,1,1-trichloroethane (TCA). The product contains a high percentage of these chemicals. The SSS Stainless Steel Cleaner Wipes contain 0.1 percent or greater carcinogen, which in this product is petroleum distillate. The 0.1 indicates the petroleum product contains greater than 0.1

percent benzene; benzene is an A1 carcinogen. The Clausen carpet solution contains Perc and toluene. The wood cleaner contains naphtha, which is a petroleum product that contains benzene. The Lemon aerosol has a main ingredient of petroleum, which contains benzene. The Nevr-dull magic wadding polish, stainless steel polish, furniture polish, and stainless steel cleaner towel all include petroleum products containing benzene. The stainless steel cleaner towel has ten to thirty percent petroleum product, a significant amount. Dr. Tsai confirmed that seven of the products listed contained benzene, an A1 carcinogen, and the other two products include Perc, which is an A2 carcinogen. The stainless steel wipes had 0.1 percent or greater of benzene, whereas the other products had 0.1 or a little less of benzene. Dr. Tsai could not find dates on all of the MSDS sheets. One was from 1986 and three others were from after 2005.

Dr. Tsai then considered Pearson's exposure to the three carcinogens she identified in the products used at Star: benzene, perchloroethylene (Perc), and trichloroethane (a.k.a. methyl chloroform or TCA). She first noted that there is no safe level of exposure to benzene, because it has been confirmed as a human carcinogen. Dr. Tsai used the general exhaust ventilation model to simulate the exposure concentration in an indoor setting. This model is the standard ventilation model used by industrial hygienists to estimate exposure when actual exposure levels have not been measured, as was the case during Pearson's employment at Star. She testified that it is common in the field of industrial hygiene to calculate exposure using such a model, and the modeling was reliable and scientific, with a published study showing experimental data and simulation data to correlate well. The particular model she chose was most appropriate for the type of exposure in Pearson's case, where the majority of his exposure happened after he applied the chemical to the surface and the chemical was evaporating. Dr. Tsai estimated that Pearson applied a five-gallon bucket of cleaning solution to a 3,000 foot square floor, based on his

description of the floor cleaning process. She used the exchange rate for fresh air exchange in an office building, based on the Industrial Hygienist White Book.

Using these assumptions, Dr. Tsai calculated that the amount of Perc released into the air would significantly overexpose Pearson to Perc each time he cleaned a floor. She based this on Pearson using 100 grams Perc each time. She noted that the third chemical on her list, a carpet solution, contained a very high percentage of Perc, 70 to 75 percent. Dr. Tsai felt the 100 gram number was a conservative measure of exposure; she believed Pearson would be exposed to more than that if he was cleaning a large area of carpet. Dr. Tsai concluded that, over twenty years of exposure, Mr. Pearson's level of Perc exposure was significant and exceeded exposure limits. Dr. Tsai opined that there was an association between exposure to Perc and 1,1,1-trichloroethane and multiple myeloma, based on the *Gold* article published in 2011.

Dr. Tsai then detailed her calculation regarding benzene exposure. She opined that Mr. Pearson's exposure to benzene was significant over the course of twenty years. She estimated that one liter of the floor cleaning solution was made up of the petroleum product that contained about 0.1 benzene. She looked at the concentration from evaporation of the cleaning solvent containing 0.1 percent or a little less of benzene and believed the air concentration would exceed exposure limits of 1 ppm within 30 minutes. Dr. Tsai explained that all petroleum products contain a trace amount of benzene that averages 0.1 percent, but government regulations only require the documentation of the concentration on the MSDS when the benzene component of a chemical product exceeds 0.1 percent. The *Constantini* study in 2008 supported an association between benzene exposure and multiple myeloma.

Dr. Tsai further testified that Pearson's exposure was all direct exposure from pouring, mixing, and applying the solvent on the surface of the floor. She opined that Pearson had been

exposed to excessive amounts of benzene and petroleum chemical solvents, based on the simulation and description of his job duties, and the accumulated exposure over 20 years was definitely significant.

On cross-examination, Dr. Tsai testified that she has held herself out as a professional industrial hygienist since she earned her PhD in 2008, but she has not yet been certified. She is not a medical doctor or a toxicologist. She agreed that the focus of her research and professional endeavors since 2003 have been in the field of nanotechnology. She has not published or presented on multiple myeloma or benzene exposure. As an engineer, she dealt with benzene every day, but not as an industrial hygienist. She is not an expert witness in medical causation. Her legal consulting work has all been on behalf of plaintiffs. Dr. Tsai is not a medical expert, so she did not review Pearson's medical records, only the report of the medical expert. Dr. Tsai has never visited the actual sites where Mr. Pearson cleaned floors and she has not viewed any photographs of the work sites, either. She could not interview Mr. Pearson because he had passed away. Dr. Tsai agreed that she did not have information about the frequency or total quantity of the cleaning products used for the products she listed and identified as containing carcinogenic materials. This would not affect her modeling, however, because she assumed that the materials would be used with some frequency over the 20 year period.

On re-direct, Dr. Tsai confirmed that her job as a safety and process engineer for a chemical company involved controlling the workers' exposure to benzene and petrochemicals.

Rhonda Pearson testified that she is 47 years old and was married to Claimant from July 1994 to the date of his death. They have two children, who are now 22 and 24. Mr. Pearson always worked for Star Building Services while they were married. He began working there in 1984. He worked about 70 hours per week in the warehouse and cleaning offices and floors. On

August 23, 2011, Mr. Pearson stopped working for Star, because he felt he was not being treated well. He had been called on vacation with notification that he was no longer a manager and his pay rate and hours had been reduced. On August 31, 2011, Mr. Pearson was diagnosed with multiple myeloma.

Gail Stewart testified for the Employer. Stewart is the CEO of Star Building Services and has worked there since 1988. Her father started the company in 1950. She began with the company doing marketing and sales. She also did cleaning and trained employees. The company employs service workers who work parttime at night to clean buildings; supervisors for each job site; managers for client accounts; and office personnel in operations and human resources. Star has over 250 clients who receive services on a regular basis. Clients include offices, schools, medical buildings, surgical centers, construction sites, churches, and corporate headquarters. Stewart frequently goes out to job sites and observes the jobs being performed. Stewart has known William Pearson since she began working at Star. He was working in the warehouse, where all paper products and cleaning supplies were stored. Pearson handled inventory, picking up items from suppliers, and making deliveries to clients' buildings. Later on, he also maintained the file of MSDS sheets for the products and distributed the MSDS sheets to job sites as needed. The MSDS sheets were kept in binders. The MSDSs were needed for any product in the warehouse, regardless of whether the product was ever used. The MSDSs are kept for at least five to seven years in case a customer requested them or for a State inspection. Stewart provided the 262 MSDS sheets currently in the Star binders. She agreed that she did not have MSDS sheets dating back 20 years. Star has been going "green" in the past several years in terms of products used.

Stewart testified that the warehouse job held by Pearson was not a cleaning job. This was his primary job. However, she acknowledged that there is a floor cleaning crew, and sometimes additional people were needed to fill in on the crew. Floor crew members trained each other, although vendors sometimes provided some training on their products. Pearson liked to do the floor work, so he was the first person called to perform this work on weekends and occasionally on weeknights. Stewart insisted that most of Pearson's work hours were during weekdays in his fulltime warehouse job. Sometimes the weekend floor work just involved cleaning, not stripping and waxing. Floor work could include floor scrubbing or high speed buffing without stripping, wax, or chemicals. A floor crew would have four to five workers.

Stewart was asked about the products of concern identified by Dr. Tsai and Dr. Osinubi. Stewart testified that SSS Spot Solvent was not used to clean hard floors. SSS Stainless Steel wipes, Scott's Liquid Gold, Lemon Pledge, Behold, Never Dull Magic Wadding Polish, and Stainless Steel Cleaner Towels were not used to clean the floor. Stewart agreed that Star used Franklin Carpet cleaner for a long time to clean carpets, but not anymore. The Clausen carpet cleaner may be included in the MSDS binder because they tried it at some point. Stewart was not familiar with the Tar, grease and paint carpet spotter. TET Glass Cleaner was not used on floors. Dri-Foam was used to clean carpets. Stewart estimated that about half as much time was spent on carpet work as the hard floor work. Star used standard size containers of cleaning products. The Liquid Gold and Lemon Pledge were used on executive-type furniture. The Liquid Gold, Pledge, and Behold were used rarely. Glass cleaner was used frequently on glass and mirrors. Stainless steel cleaning towels and wipes were used for water fountains and elevators, but were not used daily. Stewart did not see any floor waxer on either of the lists.

Stewart disagreed that ventilation was poor on weekends. Clients knew when Star was coming to perform floor work and would turn on the ventilation. The ventilation would speed up the waxing process and result in less billing to the clients. Fans were commonly used to speed up drying. Most clients' ceilings were higher than eight feet. Star had the alarm codes to open doors at the clients' facilities.

William Pearson's last work assignment was janitorial work at Siemens. Stewart testified that she worked with Mr. Pearson on a regular basis on the "start up" team for new clients. Stewart reviewed past workers' compensation claims made against Star, and she did not find any occupational disease claims involving cleaning products.

On cross-examination, Stewart testified that Star currently has about 500 employees who work in Delaware, Pennsylvania, New Jersey, and Maryland. They employed as many as 900 workers in 1988. Star did a lot of business with Franklin over ten years ago but has a long-term relationship with a different supplier now. She agreed that there were 1986 and 2008 MSDSs for Clausen products in the Star MSDS binders, but she denied that Star was using Clausen products throughout this time period. Stewart believes Star keeps the MSDSs longer than they need to. Sales representatives sometimes demonstrate products, and if Star decides to try the product, an MSDS is kept in the binder. Stewart agreed that Pearson consistently worked 60-70 hours per week and loved to work. She confirmed that Pearson and Richard Collins did the same type of work. Pearson filled in on daytime cleaning crews and for vacationing crew members. The larger floors cleaned on the weekends took more time to clean and tended to be larger spaces with better ventilation. Smaller jobs took place on weeknights, and a separate floor crew handled these jobs. Stewart disagreed that doors had to be kept closed while the work was done

or that workers were “locked in.” Star brought in the fans used to dry floors during the stripping and waxing process.

Stewart agreed that “Jack Hammer” spot cleaner was used on baseboards. Endust and Liquid Gold were used rarely, perhaps once a year. Stainless Steel wipes were used about once a week or less on elevators and water fountains. Employees were not required to get a physical. Some client facilities required vaccination, drug screening, or background checks.

Under questioning by the Hearing Officer, Stewart testified that Mr. Pearson began doing floor work on a consistent basis around the year 2000. Stewart believed the MSDS sheets for products had to be kept for five to seven years by law, but generally Star liked to keep them in case a client wanted a copy. The current MSDS binders include all the products Star currently uses, has used, or may have used for at least the past ten years, but not as far back as twenty years. Stewart confirmed that there were strippers included among the 262 MSDS sheets in the binders, but she could not remember the names. None of them appeared in the tables prepared by Dr. Tsai or Dr. Osinubi. Star has used various stripping products over the years.

James Harrison testified that he worked for Star for 25 years, starting one year after Pearson. Harrison worked with Pearson and eventually became his supervisor. Harrison is now an operations manager. Harrison has not performed floor work himself, but he has supervised floor jobs. Harrison confirmed that Plaza and Offense floor strippers had been used in the past, but now they use Bravo stripper. SSS spotter is a spot cleaner for carpet; it is not used to clean a large area. SSS stainless steel wipes and Stainless Steel polish (“Twinkle”) would be used on elevator doors and water fountains. Clausen carpet solution was a spot treatment for carpet. Liquid Gold and Lemon Pledge were used on wood desks. Nevrr-Dull magic wadding polish rag was used to polish brass. Behold polish was used on furniture. He confirmed that seven of the

nine products listed as products of concern by Dr. Tsai were not used to clean floors. The other two items were spot cleaners for carpets. The list from Dr. Osinubi did not include any floor strippers or wax either. The Gum Remover on her list was used only for removing gum from surfaces. Harrison was not sure what the Tar, grease, paint and carpet spotter was, but he insisted it was not a floor stripper or a floor wax.

Michael Greenberg, M.D., testified next for the Employer. Dr. Greenberg is board-certified in emergency medicine, medical toxicology, and occupational medicine. He has been in practice for 35 years. He is also on the faculty at Drexel College of Medicine. He testifies for both plaintiffs and defendants in legal matters.

Dr. Greenberg reviewed the medical records of William Pearson and the 262 MSDS sheets provided by the Employer. He learned that Pearson had Hepatitis C with cirrhosis, pancytopenia, and diabetes as part of his medical history. Dr. Greenberg testified that there is no known cause for multiple myeloma. A known cause is different from a factor that increases risk of a disease. Pearson had three factors that were associated with an increased risk of developing multiple myeloma: being mid-to-later age, being African American, and having Hepatitis C. Some causes have been suggested for multiple myeloma, but Dr. Greenberg denied there was any conclusive evidence that exposure to chemical solvents causes the disease. Dr. Greenberg testified that exposure and dose must be established first to discern whether causation exists for a particular patient, and he did not believe that sufficient exposure and dose existed for Pearson. The *Bradford-Hill* criteria are used by toxicologists for a formal analysis whether medical causation exists for a particular patient or group of patients. The criteria allow the toxicologist to evaluate whether an exposure and a dose were medically important or insignificant. Dr. Greenberg concluded that Pearson had no medically important exposure to a harmful chemical.

He explained that anything Pearson used was diluted, which is a very effective way to decrease exposure through inhalation. After the solution was spread on the floors and dried, only minimal exposure occurred by inhalation, because the chemicals had little ability to volatilize anymore. He also explained that 60 to 80 percent of inhaled solvents are exhaled unchanged and thus not part of the dose the person is exposed to. This reduces any exposure tremendously. If there was no medical important exposure, then there was also no medically important dose of a harmful chemical in Pearson's case. In addition, Dr. Greenberg insisted that studies cited by Dr. Osinubi (e.g., Gold, Constantini) at best only *suggested* causes for multiple myeloma. An "association" between a factor and a disease presents a possibility of causation among many possibilities, whereas exposure and dose must be established to prove causation in a particular case. Generally, an odds ratio from a population study must reach a probability of two to three or more times normal occurrence for a particular type of exposure to be accepted by epidemiologists as a causative factor. If the odds ratio is less than two to three, then the particular exposure probably did not cause the disease. Dr. Greenberg noted the odds ratios for the parameters studied in *Gold* were all less than two, which would not be accepted as showing causation. Under the circumstances present in this case, Dr. Greenberg firmly concluded that chemical exposure did not cause Pearson's multiple myeloma. He did not know what caused the disease, as was usually the case. Dr. Greenberg presented a collection of scientific studies that he believed supported his opinion. (Employer's Exhibit 2)

Dr. Greenberg reviewed the list of chemical products prepared by Dr. Tsai. He commented that MSDS sheets are notoriously inaccurate. His concern is the exposure and dose of a chemical, not simply the list of chemicals contained in a product and the percentage makeup of the product. He insisted that a threshold dose is required for even a carcinogenic chemical to

cause cancer. The way a product is used can limit a person's exposure, for example, a spot carpet cleaning product would create limited aerosol exposure in comparison to a carpet foam sprayed over an entire carpet. Dr. Greenberg confirmed that the MSDS sheets for Scott's Liquid Gold, Lemon Pledge, stainless steel polish, and stainless steel cleaner towel indicated these products had no known carcinogenicity. The MSDS for Behold indicated that no respirator was needed under normal product use. The MSDS for Never Dull Magic Wadding polish indicated the product had a low order of toxicity for skin contact and a "slight" health hazard rating of one.

Dr. Greenberg disagreed with Dr. Tsai's opinion. He felt her calculations of exposure were flawed and extremely high. Her conclusions as to exposure limits were flawed, because she did not consider that the limits were 8-hour time weighted averages. In addition, she did not include factors such as body mass index, respiratory rate, and underlying pulmonary issues that would affect exposure through inhalation. Dr. Greenberg felt Dr. Tsai's calculations were minimal and mis-applied. Also, industrial hygienists usually rely on measurements of the exposure environment, whereas Dr. Tsai used the general exhaust ventilation model, which is based on assumptions and results in speculation. He noted that few industrial hygienists will "go out on a limb" without any measurements. He further commented that benzene was ubiquitous in the environment in small concentrations.

On cross-examination, Dr. Greenberg acknowledged that it was sometimes not possible to get actual measurements. Simulations can be used under these circumstances, but they may not give accurate information. Dr. Greenberg disagreed that he failed to provide supporting detail for the statements he made in his *Bradford Hill* analysis. Dr. Greenberg insisted that his written report referred to specific facts from Pearson's case. He reviewed all the same documents Dr. Osinubi had when he prepared his written report, and based on these documents

he concluded that Pearson had no documented exposure to chemicals that cause multiple myeloma in humans. Dr. Greenberg also conducted an extensive literature search for a link between multiple myeloma and occupational exposure and made reference to this literature search in his *Bradford Hill* analysis. He did not find any link in the search between the disease and workers performing janitorial services. He testified that Pearson had several risk factors for multiple myeloma, including Hepatitis C, but agreed that Pearson had no family history of the disease. He also agreed that benzene is a carcinogen. He had no reason to doubt that the products identified by Dr. Tsai and Dr. Osinubi included benzene, perc, and TCA. He disagreed with Dr. Osinubi that many of the products included benzene, even if the chemical was not included on the MSDS; he conceded, however, that some chemicals may have traces of benzene that do not have to be reported on the MSDS sheets. Dr. Greenberg confirmed that the peak incidence of multiple myeloma occurs between 65 and 68 years of age, but he pointed out that this means half of the people who develop the disease are diagnosed at a younger age. Most people who are diagnosed are at least 65, according to an ACS article, but Dr. Greenberg pointed out that they could have first acquired the disease at a younger age. Dr. Greenberg acknowledged that the cause for most cancers is not known; however, factors have been identified for some cancers that correlate to an increased risk. Hepatitis C, age, gender, and race are accepted risk factors for multiple myeloma, but the presence of these factors does not mean a person will get the disease. The scientific studies that discuss an association between petrochemical exposure and multiple myeloma concerned workers in the petrochemical industry, that is, refining, transporting, and creating petrochemicals from oil in large factories, not janitorial workers. The *Gold* study reference to an increased risk of multiple myeloma among janitors and custodians was shown to Dr. Greenberg; the workers were suspected of exposure to

TCE through furniture polish and floor stripping products. Dr. Greenberg commented that he did not believe there was proof of a link between TCE and multiple myeloma. The doses that workers are exposed to in an industrial setting are much greater over a longer period than the minimal exposures to which Pearson was subjected. Dr. Greenberg agreed that solvent exposure may affect people with compromised immune systems, but he insisted this would be an issue where massive exposure to chemicals, with high concentrations over a long period of time, occurred in poorly controlled industrial settings, not from exposure to miniscule concentrations of chemicals that were intermittently applied. Dr. Greenberg conceded that inhaling Perc or other solvents could cause coughing and shortness of breath, but these symptoms were acute and would resolve quickly. He further insisted that the studies suggesting an association between benzene and Perc and multiple myeloma were poorly controlled or calculated relatively low odds ratios. He pointed to a letter in a medical journal that stated the etiology for multiple myeloma remained largely unknown, and that epidemiologic studies had found mixed results of an association between multiple myeloma incidence with specific occupations. The association had been found most consistently with farming and pesticide exposure and less consistently with exposure to various industrial chemicals and petrochemicals. Dr. Greenberg acknowledged that he had not seen the reports Star had recently provided detailing the number of hours Pearson had spent on various jobs while he worked for Star.

Claimant offered into the record a copy of the Modified Duty Work Form provided by the carrier to the Employer. (Claimant's Exhibit 9)

On re-direct, Dr. Greenberg testified that a chemical is identified as carcinogenic on an MSDS if it is listed as such by the EPA, NIOSH, or another governmental agency. The IARC report referenced by Dr. Osinubi identified benzene as a known carcinogen that causes leukemia,

and also identified a suspected association between benzene and non-Hodgkin's lymphoma and other lymphomas. Dr. Greenberg agreed with the statement that most cohort studies and case control studies showed no association between benzene and multiple myeloma. An ACS article indicated that studies looking at workplace exposures and multiple myeloma have found no clear link. A 2013 study by *Perrotta* could not confirm any excess risk of multiple myeloma from exposure to benzene.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

Compensability

The Estate of William Pearson ("Claimant") alleges that William Pearson (deceased) developed multiple myeloma as a result of his occupational exposure to petrochemicals while he was employed with Star Building Services ("Employer"). A Petition to Determine Compensation Due was filed on January 24, 2012 by William Pearson and pursued by the Estate after his death on October 22, 2012. The date of injury specified on the petition is August 31, 2011, the date he was diagnosed with multiple myeloma. Claimant seeks acknowledgement of an occupational disease and payment of medical bills related to the illness. The Employer denies the multiple myeloma was causally related to any exposure at work.

On its face, Claimant's petition alleges an occupational disease, and thus the Estate must demonstrate, by a preponderance of the evidence, that "the employer's working conditions produced the ailment as a natural incident of the employee's occupation in such a manner as to attach to that occupation a hazard distinct from and greater than the hazard attending employment in general." *Diamond Fuel Oil v. O'Neal*, 734 A.2d 1060, 1064 (Del. 1999); *Anderson v. General Motors Corp.*, 442 A.2d 1359, 1361 (Del. 1982). Stated another way, the employee must "establish by substantial competent evidence that his ailment resulted from the peculiar nature of the employment rather than

from his own peculiar predisposition.” *Anderson*, 442 A.2d at 1361. In establishing that William Pearson contracted an occupational illness or disease, the Estate bears the burden of proof. *See Strawbridge & Clothier v. Campbell*, 492 A.2d 853, 854 (Del. 1985) (citing *Johnson v. Chrysler Corp.*, 213 A.2d 64 (Del. 1965)).

The Estate of William Pearson argues that Pearson’s exposure to petrochemicals at work in the course of cleaning floors, rugs, and offices over a 27-year period of employment with Star Building Services caused the multiple myeloma diagnosed on August 31, 2011. Claimant offered the expert opinions of a specialist in occupational and environmental medicine, Omowunmi Y.O. Osinubi, M.D., and an industrial hygienist, Su-Jung (Candace) Tsai, Sc.D., to support its contentions. Relying on the expert testimony of Michael Greenberg, M.D., the Employer denied that Claimant has met its burden to prove that chemical exposure in the course of employment was a likely causative factor in William Pearson’s development of the multiple myeloma. The Employer disputed the extent and type of Pearson’s exposure to chemicals at work and the alleged causal link between the chemical exposure and multiple myeloma. After weighing the evidence presented, I conclude that the Estate has failed to carry its burden to “establish by substantial competent evidence that [William Pearson’s] ailment resulted from the peculiar nature of the employment rather than from his own peculiar predisposition.” *Anderson*, 442 A.2d at 1361. I therefore find that the Estate has not proved that the working conditions at Star Building Services produced William Pearson’s multiple myeloma “as a natural incident of the employee's occupation in such a manner as to attach to that occupation a hazard distinct from and greater than the hazard attending employment in general.” *Id.*

Exposure

In reaching a decision, I first consider the evidence of chemical exposure presented by the parties. Claimant established through the testimony of Pearson's longtime co-worker Richard Collins and that of Star Building Services CEO Gail Stewart that, in addition to his fulltime work duties in the Star Building Services warehouse, William Pearson worked a substantial number of additional hours on a regular basis to strip and wax hard floors, clean carpets, and perform general janitorial duties for Star's clients. Pearson used various cleaning products to perform these duties. This testimony was corroborated by a summary of hours spent in various tasks from 2006 through 2011; the summary was based on documentation provided by the Employer. (Claimant's Exhibit 6) Collins and Stewart confirmed that Pearson engaged in these types of work activities at least from the year 2000 forward, which would place Pearson's potential exposure to cleaning products – and alleged hazardous petrochemicals -- within the 10 to 15 year latency period for multiple myeloma identified by Dr. Osinubi. However, when Dr. Osinubi interviewed Pearson by telephone prior to his death, Pearson did not identify by name any cleaning products. I must therefore rely on the testimony from other Star employees to determine which cleaning products Pearson likely used and how often he used them.

Dr. Osinubi and Dr. Tsai each reviewed 262 Material Safety Data Sheets (MSDSs) produced by Star Building Services. Gail Stewart testified that these MSDS sheets represented all the cleaning products that Star either used or had tested dating back at least 10 years, but probably not as far back as 20 years. Dr. Osinubi and Dr. Tsai admitted that they had no knowledge of which of the 262 products Pearson actually used and how much he used them; their analyses and opinion assumed that he used them all in the course of his job for Star Building Services. Their testimony also made it clear they did not know how the products were used, because both Dr. Osinubi and Dr.

Tsai assumed Pearson used some of the products on their lists of “products of concern” (Claimant’s Exhibit 7 and Employer’s Exhibit 3) to strip and wax hard floors. Stewart, however, insisted that none of the products on either of their lists was used for stripping and waxing. Stewart further testified that there were stripping and waxing products included among the 262 MSDS sheets produced, so Dr. Osinubi or Dr. Tsai could have flagged those products as containing potentially hazardous petrochemicals if they felt justified in doing so; they did not. James Harrison corroborated Stewart’s testimony about the stripping products. He testified that Star had used “Plaza” and “Franklin” strippers in the past, and now used a stripper called “Bravo.” None of these appeared on the lists from Dr. Tsai and Dr. Osinubi. Harrison further explained that seven of the nine items on Dr. Tsai’s list were not used for the floor at all, and the two items that were used on floors were spot cleaners for carpet, not hard floors. Based on the evidence available, I find no basis for concluding that Pearson was exposed to any potentially harmful petrochemicals while stripping and waxing floors.

Nonetheless, other testimony established that Pearson spent a substantial amount of time cleaning carpets on the weekends, with Richard Collins estimating that he and Pearson spent about half the time cleaning carpets as they did stripping and waxing hard floors. The exhibit prepared by Dr. Osinubi indicates Pearson spent much less time than that on carpets from 2006 to 2011 (Claimant’s Exhibit 6), but this was mostly after Collins left employment with Star and also after the latency period for multiple myeloma. To give Claimant the benefit of the doubt, I will accept Collins’ testimony that Pearson spent a substantial number of hours cleaning carpets in the course of his work for Star, though much less time than he spent stripping and waxing floors. Based on the testimony from Stewart and Harrison about the carpet cleaning process, I also conclude that Pearson more likely than not used a broadly applied carpet cleaner and a spot carpet cleaner in the course of

his work cleaning carpets. The question is what products he used to perform this task, and whether these products contained potentially harmful chemicals.

Stewart testified that the Dri-Foam appearing on Dr. Osinubi's product list (Claimant's Exhibit 7) was used to clean carpets. However, none of the witnesses identified the Dri-Foam product as something Pearson had used to clean carpets. Instead, Stewart recalled Franklin carpet cleaner being used for a long time, and Collins stated that they used a dry powder or foam Franklin 3-in-1 cleaner for carpets. The Franklin cleaner does not appear on Dr. Tsai's or Dr. Osinubi's lists. I therefore find insufficient evidence Pearson used the Dri-Foam product, or a chemically equivalent product, to clean carpets for Star. Even if I were to find that Pearson used the Dri-Foam product on a regular basis to clean carpets, the petrochemical exposure levels assumed by Dr. Osinubi and Dr. Tsai in their opinions were based on the application process for strippers and waxers, not Dri-Foam carpet cleaner. Dr. Osinubi's ultimate on causation thus appears to rest on an inaccurate and incomplete understanding of petrochemical exposure from the carpet cleaning process.

In addition, I note that the chemical of concern in the Dri-Foam, as identified by Dr. Osinubi, was present in small concentrations and the MSDS for the Dri-Foam itself does not report any health hazards other than eye or skin irritation. The "key constituent" identified as a risk by Dr. Osinubi, 1,1,1-trichloroethane (TCA), is present in the product at only 1 to 2 percent concentration by weight, according to the MSDS. The other chemical of concern that Dr. Tsai and Dr. Osinubi assumed to be present in the Dri-Foam – and in all the other petrochemicals-based products on their lists—was benzene. Dr. Tsai insisted that all petrochemicals (of which TCA is one) contain some level of benzene, though benzene concentrations less than 0.1 percent do not have to be reported on the MSDS sheet. Even assuming this statement is true for the TCA in the Dri-Foam carpet cleaner,²

² Dr. Greenberg disagreed that all petrochemicals contained benzene, although he acknowledged that some petrochemicals do contain trace amounts of benzene that do not have to be reported on MSDS sheets.

this would mean that at most the Dri-Foam contained a benzene concentration of about 0.001 to 0.002 percent, which is 0.1 percent of the 1 to 2 percent TCA concentration by weight. Any benzene exposure from the application of the Dri-Foam across a large carpet area would therefore be several orders of magnitude less than the concentration assumed by Dr. Tsai in her exposure model. Both Dr. Osinubi and Dr. Greenberg agreed duration and dose of exposure were important in determining whether a chemical exposure caused a particular medical condition. With the Dri-Foam, the potential dose of TCA is relatively small and the potential dose of benzene is extremely minimal.

The other carpet cleaners that appear on the lists prepared by Drs. Tsai and Osinubi are spot cleaners, according to Harrison, not the type of cleaners spread over an entire carpet area. Stewart testified that the Clausen carpet cleaner was never used by Star; she speculated that the MSDS was present in the binder because it had been provided by a supplier for trial use. Nonetheless, Harrison was able to identify the Clausen cleaner as a spot cleaner and the MSDS identified the trade name as GTO Carpet Plus (Claimant's Exhibit 7), which is a product that Collins said he used as a spot cleaner. The other spot cleaner identified by Dr. Tsai was the SSS Spot solvent, and the MSDS for this product also provides a trade name of "GTO." (Employer's Exhibit 3) Both Harrison and Stewart recognized this product as a spot cleaner for carpet and, while they did not testify when or how much it was used, they also did not deny that Pearson may have used the product. All three spot carpet cleaners on the lists contain perchloroethylene ("perc") and toluene, both of which are petrochemicals identified by Drs. Tsai and Osinubi as key constituents that caused them concern, and the SSS Spot solvent contains TCA as well. Based on this evidence, I conclude that Pearson was likely exposed to some level of TCA, perc, and toluene on a regular basis in the course of using spot carpet cleaners. This exposure was greater than would have occurred from employment in

general. Nonetheless, exposure to these chemicals was limited significantly by the product's use as a spot cleaner rather than a general carpet cleaner. As noted earlier, Dr. Tsai and Dr. Osinubi based their analyses and conclusions about exposure on the belief that the carpet cleaning chemicals would have been mixed in a bucket and spread over a large area of carpeting. They also assumed exposure for up to 10 to 12 hours per day. These were inaccurate assumptions to make for spot carpet cleaners. I thus conclude that Dr. Tsai and Dr. Osinubi vastly overestimated exposure to petrochemicals from these type of products.

The other cleaning products identified on the lists prepared by Dr. Tsai and Dr. Osinubi were either unknown by the witnesses ("6 Tar, grease, & paint carpet spotter"), never discussed by any witness in their testimony ("paradichlorobenzene blocks"), or used for general janitorial duties rather than floor cleaning (various polishes and wipes). (Claimant's Exhibit 7 and Employer's Exhibit 3) Collins was able to confirm that he used Scott's Liquid Gold wood cleaner, Nevr-Dull magic wadding polish, Behold furniture polish, and Lemon Pledge. Stewart explained that Scott's Liquid Gold, Behold, and Lemon Pledge were all furniture polishes for wood furniture that were rarely used for Star's clients. Endust was also used rarely to clean furniture. Harrison described Nevr-Dull magic wadding polish as used to polish brass, whereas Collins recalled using it to clean stainless steel. Harrison and Stewart confirmed that several of the listed products were used to clean and polish stainless steel water fountains and elevator doors. Stewart testified that these products would be used about once a week. Another product on the list was a gum remover, which Harrison identified as being used only to remove gum from surfaces as needed. Stewart confirmed that the TET #1 Glass cleaner was used frequently to clean glass and mirrors by Star employees. The furniture polishes, stainless steel cleaners, gum remover, and glass cleaner contain various petrochemical constituents that Dr. Tsai and Dr. Osinubi identified as chemicals of concern. It

should be noted that none of these products, or any of the products on Dr. Tsai and Dr. Osinubi's lists, specifically identified benzene as a constituent. As most, it could be assumed they contained up to 0.1 percent of benzene.

In any event, I conclude from the evidence regarding the usage of non-floor cleaning products that Pearson used most of the products (furniture polishes and wood cleaners) rarely or not at all and therefore would have been exposed to a minimal amount of petrochemicals from their use at work. It would be hard to characterize this type of use and exposure as any different from the non-occupational use of similar products in a household. The only non-floor cleaning products Pearson may have used on a more regular basis because of his occupation were the glass cleaner and the stainless steel polishes or wipes (including the Nev-Dull magic wadding polish). Collins only recalled using the Nev-Dull magic wadding polish. Stewart and Harrison both testified that stainless steel was polished about once a week, so it is possible that Pearson used the Nev-Dull or one of the other stainless steel polishing products as often as once a week. Stewart also acknowledged that the glass cleaner was used frequently by cleaning staff, so even though Collins did not identify this as a product he used, it would be reasonable to infer that Pearson used the glass cleaner regularly when he performed janitorial duties. Janitorial duties were not Pearson's fulltime job, but he did fill in on janitorial crews as needed; the data provided by the Employer shows he did spend a substantial number of hours in janitorial tasks (Claimant's Exhibit 6). Based on the testimony, I conclude that Pearson likely used one or more stainless steel polishes and the glass cleaner on a regular basis while he worked for Star. These products all contained some level of petrochemical solvents, so it is reasonable to conclude that Pearson was exposed to a higher level of these chemicals as a result of his occupation than would workers in general. Nonetheless, this does

not mean the chemical exposure was harmful or can be causally linked to Pearson's development of multiple myeloma.

To summarize the evidence regarding exposure to allegedly harmful petrochemicals, I conclude that there was no evidence presented that Pearson was exposed to petrochemicals during stripping and waxing activities. I also conclude that there is insufficient evidence that Pearson was exposed to petrochemicals through the use of the Dri-Foam carpet cleaner identified on Dr. Osinubi's list or an equivalent. On the other hand, I find it likely that Pearson was exposed to petrochemicals through his use of spot carpet cleaners, stainless steel polishes, and glass cleaner at a rate greater in his work for Star Cleaning Services than would be expected from employment in general.

Causation of Multiple Myeloma

I next consider whether the work-related petrochemical exposures discussed above were a likely cause of Pearson's multiple myeloma. The exposure must be one that could be "injurious," or "of the type which could cause the disease" to be compensable. *Lake Forest School District v. DeLong*, 1988 WL 77665, at *4 (Del.Super. Ct. July 20, 1988). The medical experts examined the causal link between petrochemical exposures and multiple myeloma both through a review of medical literature on the subject and an examination of the duration and dose of chemicals William Pearson was exposed to through his work at Star Building Services, as well as non-work-related risks associated with his case. After reviewing essentially the same exposure evidence and literature, Dr. Osinubi and Dr. Greenberg reached opposite conclusions on the issue of causation. After weighing their testimony and the other evidence presented, I choose to rely on Dr. Greenberg's opinion over that of Dr. Osinubi and find that the Estate has failed to prove that

exposure to petrochemicals at work was a likely cause for Pearson's diagnosis with multiple myeloma at age 53.

A significant reason why I am persuaded by Dr. Greenberg's causation opinion is the existence of multiple non-work-related risk factors for multiple myeloma in this case. The experts on both sides agreed that Pearson had several factors which conferred a greater risk of developing multiple myeloma than he otherwise would have had, specifically, he was male, African-American, and had Hepatitis C. His age was also raised as a risk factor by Dr. Greenberg and Dr. Osinubi, because Pearson fell within the age range when most people were diagnosed with multiple myeloma, ages 45 to 70, although not within the "peak" ages of diagnosis of 65 to 70. These factors make it difficult to conclude that "the peculiar nature of the employment" at Star was a likely cause of Pearson's cancer rather than "his own peculiar predisposition." Dr. Osinubi attempted to circumvent this issue by emphasizing several times during her testimony that she believed Pearson's multiple myeloma developed *at a younger age* than otherwise would have been expected because of the petrochemical exposure; she also opined that the risk of multiple myeloma was *magnified* when petrochemical exposure was combined with the other risk factors. The age qualifier to Dr. Osinubi's opinion suggests that she may have reached a different causation opinion if Pearson had developed multiple myeloma within the "peak" years of 65 to 70. However, Dr. Osinubi never referred to any biological mechanism or medical study that would provide a scientific basis for her assertion that Pearson's petrochemical exposure *accelerated* the development of multiple myeloma. Similarly, Dr. Osinubi did not provide a scientific basis for her statement that the risk was *magnified* when petrochemical exposure was combined with the other risk factors. I find it significant that Dr. Osinubi felt it necessary to qualify her causation opinion in this way; it suggests that even Dr. Osinubi recognized the confounding effect of the other risk factors in Pearson's case.

To justify her causation opinion, Dr. Osinubi relied in large part on her belief that the medical literature supports a strong association between petrochemical exposure at work and multiple myeloma. However, I agree with Dr. Greenberg that, while some literature suggests a possible association, other studies do not, so that an association is not as strong or well established as Dr. Osinubi insists it is. Both used the *Bradford Hill* criteria to evaluate whether the literature supported a causal link between Pearson's petrochemical exposures and multiple myeloma.³ It is important to note that, at most, Dr. Osinubi is asserting that petrochemical exposure is a risk factor for multiple myeloma; both she and Dr. Greenberg agreed that, at this time, there are no known causes for multiple myeloma, only associations or possible causative factors. Nonetheless, Dr. Greenberg acknowledged that an association may be enough to establish causation if it is strong enough and coincides with a medically significant exposure. He just did not believe this was true for the case at hand.

In support of her interpretation of the literature, Dr. Osinubi referred to studies that showed an increased incidence of multiple myeloma associated with exposure to benzene, TCA, perchloroethylene (perc), and toluene, as well as studies that have linked petrochemicals to other bone marrow cancers, such as leukemia or lymphoma. She also pointed to studies showing an increased risk among cleaning or janitorial workers specifically. Dr. Osinubi primarily relied on the Benzene monograph produced by IARC (Claimant's Exh. 2) and studies authored by *Gold et al.* (Claimant's Exh. 3), *Blair et al.* (Claimant's Exh. 4), and *Spirtas et al.* (Claimant's Exh. 5). Dr. Greenberg provided a packet of twenty publications he relied upon, some of which are articles from peer-reviewed medical journals and some of which are more general publications from organizations such as the American Cancer Society and government agencies. (Employer's Exhibit

³ The Superior Court has described the *Bradford Hill* criteria as "sound scientific methodology" for evaluating whether a particular type of exposure increases the risk of developing a particular disease. *In re Asbestos Litigation*, 911 A.2d 1176, 1204 (Del. Super. Ct. 2006).

2) Dr. Greenberg cited the same IARC monograph on benzene and *Gold* study as Dr. Osinubi reviewed and he also reviewed articles that were referenced in some of Dr. Osinubi's sources. I believe both experts conducted a reasonably thorough review of the scientific literature before rendering their opinions and that individual publications can be cited in support of either opinion. However, I agree with Dr. Greenberg that Dr. Osinubi is overstating the case for an association between the type of petrochemical exposures experienced by Pearson and multiple myeloma.

Among the studies reviewed by the experts, the IARC monograph on benzene was relied upon by both Dr. Osinubi and Dr. Greenberg. This particular IARC publication is limited to an examination of benzene only, not the other petrochemicals identified by Drs. Tsai and Osinubi. The publication cites a "positive association" observed between exposure to benzene and multiple myeloma. (Claimant's Exh. 2 at 285) The monograph refers to studies that found no association between benzene exposure and multiple myeloma and to studies that did find an association with multiple myeloma; one meta-analysis indicated a 2.1 increased risk of developing multiple myeloma due to benzene exposure. (*Id.* at 261) The monograph also recognizes a much stronger link between benzene and a particular type of leukemia, concluding that benzene *causes* that type of leukemia.⁴ The evidence regarding a link between benzene and multiple myeloma does not rise to the same level. In addition to the IARC publication, Dr. Osinubi cited the *Constantini* study as showing an increase in multiple myeloma with benzene exposure. However, she also conceded that other studies showed no association between benzene and multiple myeloma or concluded that benzene did not play a major role in its etiology. The *Constantini* study also recognized that benzene was ubiquitous in the environment, though in small concentrations.

⁴ Benzene is recognized by government agencies as an A1 or "confirmed" human carcinogen; this is the only chemical cited by Dr. Tsai or Dr. Osinubi to fall into this category; however, it is important to recognize that this categorization is related to studies showing a causative link to a specific type of leukemia, not to multiple myeloma.

Additional studies cited by Dr. Osinubi in support of her causation opinion examined exposures to other petrochemical solvents, including TCA, toluene, and perc, and their relationship to multiple myeloma. Dr. Osinubi often referred to the hazards of petrochemicals in general in her testimony, but the scientific studies mostly focused on exposures to specific chemicals, not to petrochemicals in general, when looking for associations with multiple myeloma. I have no reason to believe that the results of a study on one chemical can be generalized to all petrochemical products. Dr. Osinubi cited studies reflecting 1.8, 13, and even 56 times greater risk of developing multiple myeloma from TCA exposure, 8 times greater risk from toluene exposure, and 17 times greater risk from perc exposure. Dr. Osinubi acknowledged, however, that one of the primary studies she relied upon, *Gold*, was a limited case control study and the researchers themselves recommended larger studies needed to be undertaken. The *Gold* study also found the association between TCA (trichloroethane) and perc and multiple myeloma to be less clear than the association between TCE (trichloroethylene) and multiple myeloma; TCE is not a constituent of the cleaning products identified by Drs. Tsai and Osinubi. One of the more recent studies cited by Dr. Osinubi, *Blair*, noted a slight increase in mortality from multiple myeloma from workers exposed to solvents other than TCE and advised followup attention, but the focus of the study was on exposure to TCE, not the other solvents. In addition, the *Constantini* study cited by Dr. Osinubi as evidence of an association between petrochemical agents and multiple myeloma was referring specifically to benzene, toluene and xylene. The study results should not be assumed to encompass other petrochemicals such as TCA or perc. Dr. Osinubi further testified that an increased risk among janitorial or cleaning workers had been shown in at least one study. However, the *Gold* study, which references an increased risk among janitors and custodians, appears to refer to workers exposed to TCE, not TCA, toluene, or perc. Another study, *Perrotta*, refers to an increased

incidence among female cleaning workers only, but the researchers also indicated the increase could be due to chance, thus limiting its importance.

Dr. Greenberg insisted that the studies cited by Dr. Osinubi to support her case at best *suggested* causes for multiple myeloma. He also explained that an association between a factor and disease presents a possibility of causation among many possibilities, and he emphasized that exposure and dose still had to be established to prove causation in a particular case. He further opined that an odds ratio from a population study had to show two to three times increased risk for a particular type of exposure to be accepted by epidemiologists as a causative factor. Dr. Greenberg opined that the studies Dr. Osinubi relied on were poorly controlled or calculated relatively low odds ratios. For example, he asserted that the odds ratios in *Gold* were all less than two. Another point Dr. Greenberg made was that most scientific studies that investigated an association between petrochemical exposure and multiple myeloma concerned workers in the petrochemical industry, not janitorial workers. Workers in this industry would be exposed to much greater amounts of petrochemicals than a janitorial worker using the end consumer products. Dr. Greenberg did not believe the scientific research at this point supported the conclusion that petrochemical exposure is a causative factor for multiple myeloma. He pointed to the *Graber* letter published in the *Journal of Occupational and Environmental Medicine* in 2012 that stated the etiology for multiple myeloma remained largely unknown even after more than 60 studies investigating the issue. (Employer's Exhibit 2) The letter indicated mixed results had been found regarding associations between multiple myeloma and specific occupations, with the most consistency in studies looking at farming and pesticide exposure, and less consistency with exposure to various industrial chemicals and petrochemicals. Dr. Greenberg also referred to an ACS article concluding that studies examining workplace exposures and multiple myeloma had found no clear link.

After considering the evidence provided by the experts, I conclude that Dr. Greenberg's assessment of the medical literature is more reasonable. I acknowledge there are studies suggesting that various types of petrochemical exposures increase the odds of developing multiple myeloma, and these studies could be "cherry picked" to support a causation argument. However, other studies do not support such a link or conclude that more investigation is needed. In particular, there is scarce scientific literature connecting the types of exposures Pearson would encounter in his occupation as a janitorial or cleaning worker to an increased risk of multiple myeloma.

Even if exposures to certain petrochemicals were generally accepted as strongly associated with an increased risk of multiple myeloma, Dr. Greenberg insisted that Pearson's work exposures must be of sufficient dose to be considered a likely cause for his case of multiple myeloma. He did not believe the evidence showed Pearson was exposed to medically significant doses of chemicals during his work for Star. For example, in the case of benzene, Dr. Osinubi assumed that Pearson was exposed to benzene through contamination of other petrochemical constituents of cleaning products, with the benzene present, if at all, at concentrations of no more than 0.1 percent of the petrochemical constituents, but no documentation shows the amount of benzene contamination in these products. In addition, Dr. Osinubi and Dr. Tsai misunderstood how Pearson used the spot carpet cleaners, glass cleaner, and polishes for which there is exposure evidence. They overestimated Pearson's exposure to petrochemicals in these various cleaning products, because they assumed Pearson mixed the cleaning chemicals in a bucket, spread them over large areas of flooring, and was exposure to them for up to 10 to 12 hours at a time. They also assumed poor ventilation in the areas where the products were used, whereas Stewart testified that the work was done in office buildings and medical centers where the clients knew in advance that the workers would be present and would turn on the ventilation systems. I agree that Pearson was exposed to

some petrochemical solvents, including TCA, toluene and perc, through his use of spot carpet cleaner, stainless steel polishes, and glass cleaner. However, the use of these types of products would be on a limited area for a limited period of time, not over a large area for an extended period of time. Given the uncertainty around the potential sources of petrochemical exposure in Pearson's case, and the likelihood that any exposure would have been in small amounts for limited periods of time, I find Dr. Greenberg to be persuasive in arguing that no medically important exposure to petrochemicals took place in Pearson's case.

After considering the evidence regarding the duration and dose of potential petrochemical exposure from Pearson's cleaning activities for Star, along with the additional risk factors present in Pearson's case and the mixed support in the medical literature for a causal association between petrochemicals and multiple myeloma, I conclude that the Estate of William Pearson has not met its burden to prove that his exposure to petrochemicals in the course of his work for Star Building Services caused his multiple myeloma. I therefore find that the Employer's working conditions did not produce Pearson's multiple myeloma as a natural incident of his occupation "in such a manner as to attach to that occupation a hazard distinct from and greater than the hazard attending employment in general." The Estate's petition is therefore denied.

STATEMENT OF THE DETERMINATION

For the reasons set forth above, Claimant's Petition to Determine Compensation Due is denied.

IT IS SO ORDERED THIS 21st DAY OF OCTOBER, 2014.

INDUSTRIAL ACCIDENT BOARD

Susan D. Mack

SUSAN D. MACK

Workers' Compensation Hearing Officer

Mailed Date: 10-22-14

bc

OWC Staff