LEXSEE 8 MASS. L. REP. 373

Carol Rowe Rhilinger v. Leslie G. Jancsics et al.

93-2223

SUPERIOR COURT OF MASSACHUSETTS, AT NORFOLK

8 Mass. L. Rep. 373*; *1997 Mass. Super. LEXIS 11

December 29, 1997, Decided
January 6, 1998, Filed

JUDGES: [*1] Julian T. Houston, Justice of the Superior Court.

OPINION BY: JULIAN T. HOUSTON

OPINION

MEMORANDUM OF DECISION AND ORDER ON DEFENDANTS' MOTIONS UNDER DAUBERT

I. INTRODUCTION

This case involves allegations by plaintiff Carol Rowe Rhilinger ("Rhilinger") that she contracted Toxic Solvent Encephalopathy ("TSE") after exposure to chemicals stored in the basement of the building in which she lived. Rhilinger alleges negligence by defendants Leslie G. Jancsics, Rhilinger's then landlord; Alice Payzant, the property manager of the building; and Contract Cleaning Collaborative, Inc. ("CCCI"), the company that stored the chemicals in the basement. Rhilinger alleges that the defendants improperly and illegally stored the chemicals so that fumes migrated into her apartment and that she suffered brain damage as a result of her chronic inhalation of those fumes.

The defendants filed two motions in limine seeking to exclude expert testimony regarding the diagnosis and cause of Rhilinger's injuries. The motions were the subject of five days of hearing under *Daubert v. Merrell Dow Pharmacouticals, 509 U.S. 579, 125 L. Ed. 2d 469, 113 S. Ct. 2786 (1993)*, for the court to make a determination about [*2] the scientific reliability and admissibility of the expert opinion. The reasons for the court's decisions are set forth in detail below.

(1) Defendants' Motion in Limine To Exclude Plaintiff's SPECT Scan and All Testimony Concerning the SPECT Scan (Docket No. 58a), is DENIED.

(2) Defendants' Motion in Limine to Exclude Testimony of Plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy (Docket No. 74a), is GRANTED in part and DENIED in part.

II. BACKGROUND

Rhilinger was a tenant at 41 Columbian Street in South Weymouth, Massachusetts (the "Property") from October 1983 through February 1992. CCCI became a tenant in late 1987 and began storing various cleaning chemicals and solvents in the basement of the Property. In early 1988, Rhilinger began smelling strong chemical odors in her apartment. Thereafter she experienced various physical and cognitive symptoms including fatigue, dizziness, memory loss, hoarseness and stuttering in her speech. On September 3, 1991, she was seen for these health problems by Dr. Howard Hu at the Center for Occupational and Environmental Medicine at the Massachusetts Respiratory Hospital. (Trans. I: 119.) [*3] On that date, Dr. Hu made a preliminary diagnosis of Toxic Solvent Encephalopathy ("TSE"). (Trans. I: 127.) Ultimately, plaintiff was diagnosed with both TSE and Multiple Chemical Sensitivity ("MCS").

On September 19, 1991, Jeffrey May of J. May Home Inspections ("JMHI") inspected the Property to assess the conditions that might provide an explanation for Rhilinger's symptoms. (Plaintiff's Exhibit 10, p. 1 (hereinafter "P. Exh.").) JMHI suggested further air quality testing of the Property. (P. Exh. 10, p. 4.) On October 15, 1991, the day after Columbus Day, David Gordon Associates, Inc., ("DGA") an environmental consulting and engineering company that specializes in the measurement of air quality, industrial hygiene and air pollution control, conducted three air quality tests in Rhilinger's building. (Affidavit of David Gordon 10, (hereafter "Gordon Aff.")) The purpose of this testing was both to determine whether the solvents stored in the basement were migrating into Rhilinger's apartment and to identify and quantify these solvents. (Gordon Aff. 9.)

On November 26, 1991, Dr. Hu notified Mr. Paul Abody, Director of the Division of Occupational Hygiene at the Massachusetts [*4] Department of Labor and Industries, of a possible public health problem at the Property. (Trans. I: 122-23; P. Exh. 14.) The Board of Health for the Town of Weymouth inspected the premises and notified defendants that the condition of their property violated state and local law. (P. Exh. 15.)

On October 8, 1993, plaintiff filed this complaint against defendants to recover for brain damage that she allegedly sustained from her chemical exposure while a resident at the Property. The parties proceeded with discovery and a trial date of October 28, 1997 was set. On July 24, 1997, defendants filed a motion to exclude the testimony of plaintiff's experts and all evidence of the diagnosis of Multiple Chemical Sensitivity ("MCS"), under *Daubert, supra* and *Commonwealth v. Lanigan, 419 Mass. 15, 641 N.E.2d 1342 (1994)*. (Docket No. 56a.) A hearing was scheduled on defendants' motion.

After a conference in chambers on September 12, the court issued an Order excluding all evidence regarding the diagnosis of MCS and ordering that the hearing would go forward on the plaintiff's diagnosis of TSE. (Docket No. 70.) On September 17, 1997, the morning of the first day of hearing, [*5] defendants filed a Motion in Limine to Exclude Testimony of plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy (Docket No. 74a). At the same time plaintiff filed a Motion for Clarification on *Daubert* Issues (Docket No. 71). In that motion, plaintiff sought clarification as to the issues she would be required to prove in the hearing.

After argument by both sides, the court limited the issues to be addressed in the evidentiary hearing to the following:

i. The scientific reliability of plaintiff's evidence demonstrating the relationship between the chemicals xylene, toluene, and 1,1,1,-trichloroethane and the disease TSE.

ii. The scientific reliability of using blood tests as a diagnostic test for TSE.

iii. The scientific reliability of using SPECT scans as a diagnostic test for TSE.

Five days of hearing were held in which testimony was taken from two of plaintiff's expert witnesses, Howard Hu, M.D., a Doctor of Occupational and Environmental Medicine, and David Gordon, Ph.D., a Certified Industrial Hygienist and Specialist in Air Pollution. Defendants called no witnesses in rebuttal. The parties submitted over sixty exhibits and affidavits [*6] that were received into evidence. The court's consideration of the substance of these affidavits is, of course, limited by its previous rulings as to their admissibility. (*See* Docket No. 85.)

1. *Daubert/Lanigan* Standard

At trial plaintiff has the burden of showing both specific and general causation. That is, she must show that chronic low level exposure to the chemicals at issue can cause TSE; and that the dose of chemicals to which she was allegedly exposed more likely than not caused the TSE. *Whiting v. Boston Edison Co., 891 F. Supp. 12, 20, 1995 WL 115885 (D.Mass. 1995)*. Plaintiff proffered the testimony of at least four doctors, a toxicologist and a certified industrial hygienist to meet this burden at trial.

Defendant's motion in limine seeks to test the scientific reliability and hence admissibility of plaintiff's experts' opinion testimony on the issue of both general and specific causation under *Daubert* and *Lanigan, supra*.

For seventy years, until the Supreme Court's decision in *Daubert*, the federal courts applied the so-called *Frye* standard for the admissibility of scientific expert opinion. *Frye v. United States, 54 App. D.C. 46, 293 F. 1013* [*7] *(D.C. Cir. 1923)*. The *Frye* standard limited admissible scientific expert testimony to expert opinion based on scientific techniques that are considered " 'generally accepted' as reliable by the relevant scientific community." *Daubert at 584*.

In *Daubert*, however, the Supreme Court expanded the scope of admissible scientific expert opinion to conform with the liberal notions embodied in the Federal Rules of Evidence. 509 U.S. at 588. Instead of basing admissibility on an absolute pre-requisite of "general acceptance," the inquiry as to whether a scientific opinion is admissible, focuses on the relevancy and evidentiary reliability of that opinion. Thus, the proposed testimony should foremost be reliable scientific knowledge

that will "assist the trier of fact in determining a fact in issue." *Daubert at 589*.

To reach this benchmark, the opinion must both be "supported by appropriate validation," *Daubert at 590*, and "be sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute." *Daubert at 591*, (quoting *U.S. v. Downing, 753 F.2d 1224, 1242 (3rd. 1985)*); *In Re Paoli R.R. Yard PCB Litigation, 35 F.3d 717, 741-743* [*8] *(3rd Cir. 1994), cert denied, sub nom, General Electric Co. v. Ingram, U.S. 513 U.S. 1190, 115 S. Ct. 1253, 131 L. Ed. 2d 134 (1995)*. In other words, there must be a demonstrated valid scientific connection to the fact finder's inquiry before the opinion will be admissible.

The reasoning and standards elucidated in *Daubert* were accepted by the Massachusetts Supreme Judicial Court in *Lanigan, supra, 419 Mass. 15, 26 (1994)*. In *Lanigan* the SJC agreed that the judge must make "a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue." *Id.*

The focus of the inquiry, of course, is not on the conclusions of the proffered expert, but rather, on the reliability of the principles and methodology employed by the expert and the application of the expert opinion to the facts of the case. *Daubert at 595*. Thus, where there are flaws large enough that the expert lacks good grounds for his or her conclusion, the court should exclude the proffered opinion. *See Heller v. Shaw, 1997 U.S. Dist. LEXIS 12399*, Civil Action 95-7657 (August [*9] 15, 1997, U.S. Dist. Ct. E.D.P.A.) When determining whether there are "good grounds" for the opinion, among the factors a court should consider are whether the reasoning or methodology has been subject to peer review; can be replicated within a known rate of error; is generally accepted as valid within the relevant scientific community; and was developed using sound scientific methods--such as using control groups or large and unbiased sample pools. *See Daubert at 593-95*; *Heller* at 16-17; and *Lanigan at 25*.

It is with this standard in mind that the court evaluates the evidence presented by the parties.

2. SPECT Scan

Defendants challenge the validity of plaintiff's doctors use of a SPECT brain imaging scan to diagnose Rhilinger with TSE. Defendants argue that the use of SPECT scanning for the diagnosis of a brain injury due to chemical exposure is not supported by valid scientific evidence; has not been empirically or properly tested or studied; and has not been generally accepted as a diagnostic tool for TSE in the relevant scientific and medical communities. They, therefore, conclude that evidence of the SPECT scan and its results should be excluded.

SPECT [*10] scanning is an imaging technique that provides both an image of the brain's structure and an indication of its function. The patient is injected with a chemical known both to be metabolized by the brain and to attach to a radial compound that appears on the scan. The image produced by the scan shows where the brain absorbed the chemical and thus the level and location of metabolic activity within the brain. This picture allows an interpreter of the scan to see what areas of the brain are functioning normally and where there may be deficiencies. (Affidavit of Dr. Hu, 27 (hereafter "Hu Aff."); Trans. I: 143-44.)

The technology of SPECT imaging has been used by the medical community for at least fifteen years. (Trans. I: 144; Affidavit of Dr. Johnson, 9 (hereafter "Johnson Aff.")) Its use is well recognized "in the management of patients [suffering from] stroke, epilepsy, brain tumors and dementia." (Journal of Nuclear Medicine, Vol. 37, No. 7, July 1996, Society of Nuclear Medicine Brain Imaging Council, Ethical Clinical Practice of Functional Brain Imaging, p. 1256.) Scan abnormalities have also been identified in patients who suffer from any of a number of psychiatric disorders, [*11] but no studies have confirmed consistent abnormality patterns in these patients. (*Id*.) In addition, as of July 1996, although research studies showing a link between SPECT abnormalities and patients with neuro-toxic exposures were showing promise, there is not "adequate evidence to support the use of SPECT . . . to establish cause-and-effect relationships" between such exposures and scan abnormalities. (*Id. at 1257*.)

Plaintiff proffered evidence of two separate SPECT scans that show abnormalities in her brain function, one on March 29, 1994 and one on February 19, 1997. (Johnson Aff. 14.) Dr. Hu stated unequivocally that the SPECT scan was not his sole diagnostic tool when coming to the conclusion that Rhilinger had TSE. (Trans. I: 146.) Indeed, Dr. Hu's testimony was that the result of a SPECT scan could not definitively rule in or rule out the diagnosis of TSE. (Trans. I: 133-34.) In spite of the scan's inability to make that pinpoint diagnosis, in Dr. Hu's experience, individuals who have a history of exposure to chemicals are at a higher risk of having abnormal SPECT scan results. (Trans. at 147.) In addition, Rhilinger's scan results are consistent with the results [*12] of those individuals. (Trans 147-48.) The conclusion that Rhilinger's results were consistent with other individuals who have a reported history of chemical or solvent exposure is seconded by Dr. Johnson. (Johnson Aff. 15.) Rhilinger had no other identifiable disease or diagnosis to account for her abnormal scan results. (Hu Aff. 27.) In addition, her MRI was normal, ruling out

other possible causes of her cognitive difficulties. (Johnson Aff. 14, Hu Aff. 27, Trans. I: 130-31.)

There is no dispute that SPECT scans show abnormalities in brain function. Neither is there a dispute that SPECT scans cannot conclusively establish the existence or nonexistence of TSE in a patient. Plaintiff's experts do not opine that the SPECT scan does, in fact, establish the diagnosis. They merely assert that it is one of a constellation of diagnostic tools which they used and considered consistent with their conclusion that Rhilinger suffers from TSE.

There also is no dispute that SPECT scanning is relevant to prove or disprove the other possible explanations for plaintiff's condition. The scientific evidence submitted by both parties approves of the use of SPECT scans to identify other brain [*13] disorders such as epilepsy, stroke and dementia. Plaintiff's proffered expert testimony does not go beyond what is considered scientifically defensible use of SPECT scan technology. For these reasons, the court finds that the SPECT scan is scientifically reliable and testimony as to its use in coming to the diagnosis of TSE would be helpful to a fact finder in this case. *See Hose v. Chicago & N.W. Transp. Co., 70 F.3d 968, 973 (8th Cir. 1995)* (district court did not abuse its discretion by allowing testimony that clearly showed the limited use of a PET scan to determine the cause of plaintiff's manganese encephalopathy).

Defendants' Motion in Limine to exclude Plaintiff's SPECT Scans and All Testimony Concerning the SPECT Scan (Docket No. 58a), therefore, is DENIED.

3. Blood Testing

The second issue addressed at hearing was the validity of blood tests administered to Rhilinger. Defendants did not dispute the scientific validity of the administration or methodology of the tests. Rather, they challenged the use of the blood tests to diagnose plaintiff's condition. As with the SPECT scan, the blood tests were used to rule in or rule out other possible causes of Rhilinger's [*14] symptoms. (Trans. I: 131-32.) They also were used to determine whether there existed elevated levels of chemicals in Rhilinger's blood. (Trans. I 135-38.) None of plaintiff's experts opined that the blood tests could, with certainty, determine that Rhilinger suffered from TSE. The test was used for limited and valid purposes.

As to evidence of blood tests, defendants' motion in limine (Docket No. 74a) is, therefore, DENIED.

4. Toxic Solvent Encephalopathy

There is no dispute that CCCI stored various cleaning chemicals and solvents in the basement of the Property. In early 1988, shortly after CCCI became a tenant, Rhilinger began smelling strong chemical odors in her apartment. Thereafter she experienced various physical and cognitive symptoms including fatigue, dizziness, memory loss, hoarseness and stuttering in her speech. On September 3, 1991, she was seen by Dr. Howard Hu at the Center for Occupational and Environmental Medicine at the Massachusetts Respiratory Hospital. (Trans. I: 119.) On that date Dr. Hu took Rhilinger's full occupational, medical and environmental history. (Trans. I: 119.) Dr. Hu also made a preliminary diagnosis of Toxic Solvent Encephalopathy ("TSE"), [*15] (Trans. I: 127), a diagnosis that he later confirmed.

Dr. Hu testified that, to a reasonable degree of medical certainty, Rhilinger suffered from TSE. He also testified that, in his opinion, "the solvent exposures endured by Ms. Rhilinger at her house were the major contributing factor towards the causation of [this condition]." (Trans. I: 153-54.) After his review of the evidence, he could see no source for the elevated chemicals in Rhilinger's blood and apartment other than the solvents located in the basement. (Trans. II: 45.) It is the scientific basis on which Dr. Hu's opinion rests that the defendants challenge with their motion.

There is no single test which, by itself, is conclusive of TSE. (Trans. I: 102.) Rather, the doctor must use the process of "differential diagnosis" to come to a medically reliable conclusion about the cause of the patient's reported symptoms. This process is "the only approach for making a [medical] diagnosis." (Trans. I: 104); *See also Paoli supra at 758-59.*

Specifically, the important ingredients in making a diagnosis of TSE are: A) identifying exposure to a chemical that could cause the disease; B) identifying that the exposure [*16] was at a level significant enough to cause the disease; and C) examining the patient carefully for signs of an alternative explanation for the symptoms. (Trans. I: 102.) To make a diagnosis of TSE, the clinical physician, therefore, must look at the patient's clinical and exposure history, physical examination, and a constellation of diagnostic tests to reach his conclusion. (Trans. I: 101.)

A. Identified Exposure i. Presence of Solvents

As is his practice, on her first visit to the clinic in September 1991, Dr. Hu interviewed Rhilinger to ascertain her history of occupational or community exposure to chemicals. (Trans. I: 199.) Rhilinger reported the presence of chemicals in her basement and the strong chemical odors which she attributed to them. Because of her report, and a lack of other occupational, home or historical solvent exposure, Dr. Hu strongly suspected that Rhilinger's symptoms were some sort of solvent related neurotoxic problem probably caused by the chemicals stored in the basement of her building. (Trans. I:

119-23.) At that time, however, he did not have any data confirming that conclusion. (Trans. I: 123-24.) On November 13, 1991 Rhilinger submitted to a blood [*17] test to measure the levels of chemicals in her blood. (P. Exh. 13.) This blood test showed elevated levels of chemicals. (P. Exh. 13; Trans. I: 139-42.)

On September 19, 1991, Jeffrey May of J. May Home Inspections ("JMHI") inspected the Property to assess what conditions might be leading to Rhilinger's symptoms. (P. Exh. 10, p. 1.) JMHI noted the presence of chemicals at the Property; a sensation of stinging of his eyes, burning on his lips, and the odor of organic solvents suggesting some leakage around the bottle caps; the upward flow of air from the basement into the stairwell leading to plaintiff's apartment; and air gaps around plaintiff's front door. (*See* P. Exh. 10.) JMHI suggestions included: air testing to determine the presence of organic solvents; an investigation of whether CCCI could legally keep such solvents in the basement; and medical advice and diagnosis. (P. Exh. 10, p. 3-4.)

On October 15, 1991, the day after Columbus Day, David Gordon Associates, Inc., ("DGA") an environmental consulting and engineering company specializing in measurement of air quality, industrial hygiene and air pollution control, conducted three air quality tests at the Property. [*18] (Affidavit of David Gordon 10, (hereafter "Gordon Aff.").) The testing was conducted both to determine whether the solvents stored in the basement were migrating into Rhilinger's apartment and to identify and quantify these solvents. (Gordon Aff. 9.)

DGA conducted its tests in three different locations at the Property: inside plaintiff's apartment; in the stairway leading from the basement to her apartment; and just outside the door of the storage room where the solvents were stored. (Gordon Aff. 10.) The results from DGA's testing showed the presence and quantity of volatile organic compounds (VOCs) including xylene, toluene and 1,1,1,-trichloroethane, each in at least one of the testing locations. (Gordon Aff. 13; and P. Exh. 12.) These three chemicals are known to have neurotoxic effects on human beings if exposure approaches the necessary level and duration. (Trans. II: 41.) DGA also documented the so-called "chimney effect" in the stairway of the Property. The chimney effect would naturally result in the migration of chemical fumes up the stairway leading to plaintiff's apartment. (Gordon Aff. 18.)

On November 26, 1991, Dr. Hu notified Mr. Paul Abody, Director of the [*19] Division of Occupational Hygiene at the Massachusetts Department of Labor and Industries, of a possible public health problem at the Property. (Trans. I: 122-23; P. Exh. 14.) The Board of Health for the Town of Weymouth then inspected the premises and notified defendants that the condition of their property violated state and local law. (P. Exh. 15.) The Director of Public Health, Richard T. Marino, noted that "at the time of the inspection, strong odors from the cleaning chemicals kept in storage were observed, mostly in the storage area but up to and including the interior of apartment # 3. These odors are obnoxious and are a nuisance as provided under Massachusetts General Laws Chapter 111 and Weymouth Board of Health regulation # 17." (P. Exh. 15.)

ii. Exposure to Identified Chemicals

Among the chemicals identified by DGA as present in at least one of the three testing locations were xylene, toluene and 1,1,1,-trichloroethane, all are known to have neurotoxic effects and can cause brain damage, if the patient's exposure to the chemical approaches the necessary level and duration. (Trans. II: 41; P. Exh. 21, Documentation of the Threshold Limit Values and Biological Exposure [*20] Indices, 6th ed., 1991, American Conference of Industrial Hygienists, Inc., p. 1571-77, 1735-36; Affidavit of Dr. Laura Green, dated September 16, 1997 (hereafter, "Green Aff.")) Although other chemicals were identified during testing in the apartment building, plaintiff claims that it is these VOCs that were the cause of her injuries. The VOCs were also identified in her bloodstream at slightly elevated levels during tests taken in November of 1991. (Trans. I: 140-41; P. Exh. 13.) The results from these blood tests typically underestimate the patient's true exposure, because of the chemicals' rapid rate of clearance from the bloodstream. (Trans. I: 141.)

By their nature, these compounds are readily absorbed by fats in the body. This quality enables the chemicals to easily cross the blood brain barrier which is the brain's main protection from circulating chemicals. (Trans. I: 92.) A neurotoxin can affect either the central nervous system: the brain and the spinal cord; or the peripheral nervous system: the nerves that go from the spinal cord to the muscles. (Trans. II: 37.) Neurotoxins do not have the singular effect of causing permanent brain damage, although they can. (Trans. [*21] II: 37-40.) The damage inflicted by exposure to a neurotoxin can be acute or chronic and long or short term. (Trans. II: 37.)

In addition, there are numerous government agencies and health organizations that have promulgated guidelines, recommendations and regulations regarding permissible and unhealthy levels of exposure to these chemicals. (Trans. II: 50-56.) Most of these standards refer to allowable concentrations of these organic compounds in a workplace setting, (Trans. II: 50), although the Massachusetts Environmental Protection Agency has promulgated Ambient Allowable Levels ("AALs") which are generated for outdoor air quality. (Trans. IV: 150.)

Defendants did provide some articles casting doubt on the capability of these chemicals to cause brain damage. (*See* Trans. I: 52-57.) In this court's view, however, Dr. Hu satisfactorily explained the limitations of these studies. (*See* Trans. I: 98-100.) In addition, defendants' expert Dr. Green, states that at least at some dosages, these chemicals can cause both temporary and permanent central nervous system alteration. (Green Aff.)

Based on the medical literature, Dr. Hu's testimony, Dr. Green's affidavit, [*22] and the wealth of regulations governing these solvents, this court is satisfied that it is commonly accepted in the medical community, and has been reliably and scientifically documented, that the chemicals xylene, toluene, and 1,1,1,-trichloroethane are neurotoxins capable of causing permanent brain damage such as TSE. What has not been scientifically validated is that these chemicals can cause brain damage at any level of exposure.

This court is also satisfied that the plaintiff's report of strong odors of chemicals in her apartment, together with the reports of JMHI and DGA, the Weymouth Board of Health's citation for violation of the law, and plaintiff's elevated blood test, were the type of evidence of chemical exposure commonly relied upon by clinical physicians in occupational medicine to determine that exposure had probably occurred.

B. Levels of Exposure

No doctor can come to a reliable opinion about whether exposure to chemicals was the cause of permanent brain damage in a given patient, without first obtaining information about the patient's level and length of exposure. (Trans. II: 39-40.) Indeed, the neurotoxic effects of toluene, xylene and 1,1,1,-trichloroethane [*23] vary depending on the duration and level of exposure and the particular susceptibility of the individual. (II: 39-41.) Duration of exposure is a critical variable in determining the ultimate toxicity of a chemical in a person's system. (Trans. I: 131.) If an exposure were for a short period, but at a high level, the lasting toxicity could be limited, while it could be quite significant and deep if the exposure were at a lower level but occurred over a period of months to years. (Trans. I: 131.)

Since the level and duration of plaintiff's exposure to the chemicals is critical in the diagnosis, so is it critical for plaintiff to show proof of exposure at a level and duration that has been scientifically demonstrated to cause TSE. Without a showing of such scientifically reliable proof, the entire basis for her expert's testimony is questionable under the so-called "fit" requirement of *Daubert*. *See Paoli* 741-43. That is, the expert testimony would not assist the trier of fact at trial. *Id*. The court, therefore, now turns to plaintiff's proof on this issue.

i. Lay witness reports of exposure

Rhilinger reported strong odors of chemicals in her apartment over the three-year [*24] period from 1988-91. (Affidavit of Carol Rowe Rhilinger, P. Exh. 6.) At least one other tenant, Cecile Hannon, also reported odors of chemicals in her own apartment. (P. Exh. 11.) The Town of Weymouth Board of Health inspected the premises and issued a citation, concluding that the stored chemicals were a nuisance and a violation of local law. (P. Exh. 15.) The inspector noted the presence of identifiable chemical odors during his visit to the property, most heavily in the storage area, but up to and including Rhilinger's apartment. (*Id*.) During its inspection, JMHI also observed noticeable chemical odors. (*See* P. Exh. 10.) These reports are significant as evidence of occasions when the levels of chemicals in the apartments reached at least the sensory odor threshold. (Trans. IV: 170.)

Virtually all chemicals have a sensory odor threshold. The point after which the air concentration of a given chemical surpasses its sensory threshold is when the chemical's odor becomes detectable. (Trans. II: 154-55.) Thus, if lay witnesses report smelling chemical odors, it is safe to conclude that the concentration of the chemical in the air, and the concomitant human exposure, has at [*25] least reached the sensory odor threshold. (Trans. II: 155-57.)

Plaintiff proffered the testimony of David Gordon, Ph.D., a Certified Industrial Hygienist both by affidavit and at the hearing. Mr. Gordon is the principal owner of DGA and supervised DGA's assessment and testing of the air quality at the Property. DGA was hired to identify and quantify the chemicals allegedly migrating into Rhilinger's apartment. Consistent with standard Industrial Hygiene practice, DGA's assessment included interviewing Rhilinger and her neighbors to obtain their observations about any chemical odors or other indications of exposure. (Trans. IV: 154.) In addition, DGA relied upon the Town of Weymouth and JMHI reports. (Trans. 160-70.) Industrial hygienists typically rely on such reports and interviews when assessing and deciding what type testing should be performed. (Trans. IV: 154-56.)

Reliance upon anecdotal reports of chemical odors suffices for a determination that generally, exposure to chemicals has occurred. In this court's view, however, reliance on such reports for proof of a specific dose of a specific chemical is problematic. Plaintiff's theory depends upon proof of chronic, long [*26] term, low level exposure to three specific VOCs. The anecdotal reports simply state that there were times over a three-year period when the witnesses noticed chemical odors. Plaintiff has supplied the court with over sixty Material Safety Data Sheets ("MSD Sheets") for the chemical products

stored in the basement of the Property. (P. Exh. 17.) Although plaintiff asserted that the MSD Sheets revealed the presence of the named VOCs, it was difficult for this court to identify which products actually contained the three named VOCs. Dr. Hu, however, represented that he reviewed MSD Sheets, and that the products contained the offending chemicals. (Trans. II: 111.) In addition, there does not appear to be a serious dispute as to the presence of the VOC's in the basement.

Nevertheless, it is clear that only some of the products stored in the basement contained the VOCs that Rhilinger attributes as the cause of her condition. In addition, none of the witnesses testified to having an ability to distinguish one VOC from another, by odor. In short, the chemicals that witnesses report smelling cannot, with certainty, be identified as the three named VOCs, and therefore, such reports are insufficient [*27] on their own to sustain plaintiff's burden of proof on exposure to the three VOCs at even the sensory odor threshold.

ii. Air Quality Testing

As part of DGA's assessment of the air quality at the Property, it conducted two phases of air quality testing. The first phase was conducted to determine the total amount of chemicals in the air at the testing locations. (Trans. IV: 52-53.) The second phase was conducted to breakdown those totals to identify and quantify the individual chemicals. (Trans. IV: 53.)

Practitioners generally use aggressive testing conditions to obtain an accurate representation of the typical air quality in a testing area. Aggressive conditions exist at those times during which, or just after, the testing location is being used in its normal capacity. (Trans. IV: 58.) It was Gordon's opinion that the testing conditions at the property were not aggressive. (Trans. IV: 58-59.) Gordon's opinion was based on his assumption that on the date of testing, the day after the Columbus Day holiday, regular use of the chemicals had not been undertaken for three days. (Trans. IV: 63.) Mr. Gordon had no actual evidence of this fact, nor did plaintiff offer such evidence [*28] from any other source.

DGA used a standard method of collecting air samples as recommended by National Institute of Occupational Safety and Health ("NIOSH"). (Trans. IV: 84.) This method entails using a small tube of highly purified activated charcoal, a substance with a tendency to collect organic compounds, to collect the samples. (Trans. IV: 81.) This tube is hooked up to an air pump that draws from the testing site. The air flow is regulated and measured by the testing unit to inform the tester how much air is flowing through the tube. (Trans. IV: 81.) DGA used this collection method at each of three testing sites, 1) inside plaintiff's apartment; 2) in the stairway between plaintiff's apartment and the basement; and 3) just outside of the closed door of the area where the chemicals were being stored.

Once a sample is collected, the carbon is transported to a laboratory where it is treated with another chemical for which the organic compounds have a greater affinity. (Trans. IV: 81.) This liquid is then injected into a gas chromatograph which produces a picture of the chemicals present in the sample. (Trans. IV: 82.) The data from the chromatograph is used to make various [*29] calculations from which the tester can determine the total VOC concentration. (Trans. IV: 83.) Phase one of the testing produced the following concentrations of total VOCs: 3,380 micrograms per cubic meter outside the door of the storage area; 1,930 micrograms per cubic meter in the stairway; and 1,500 micrograms per cubic meter inside plaintiff's apartment. (P. Exh. 12, p. 2.) The concentration in plaintiff's apartment was five to ten times higher than one would normally find in a household. (Trans. IV: 87.)

The second phase of testing was undertaken because of the elevated concentrations of VOCs found during the first phase of testing. (Trans. IV: 53.) The goal of the second phase of testing was to identify and quantify the individual chemicals found in the samples. No new samples were taken; rather, the original samples were subjected to additional tests. (Trans. IV: 116.) In this phase of the testing, DGA sent the samples to an outside certified laboratory (Trans. IV: 123-24), the IEA laboratory, that had a mass spectrograph. Similar to the gas chromatograph, the liquid containing the organic compounds is injected into the mass spectrograph. The mass spectrograph breaks apart [*30] the individual molecules of chemicals and then identifies and quantifies them. (Trans. IV: 126-28.) The results of the test were then sent to DGA which, in turn, calculated the quantities of each chemical that was detected and determined by the mass spectrograph.

DGA determined that the concentrations of the three chemicals in the apartment, in micrograms per cubic meter, were the following: xylene, 657; toluene, not detected; 1,1,1,-tricholorethane, 238. (P. Exh. 12, p. 4.) The chemicals were also detected outside the storage area. (P. Exh. 12.)

The Ambient Allowable Level ("AAL") for outdoor air quality set by the Massachusetts EPA for xylene is 11.8 micrograms per cubic meter. (Trans. IV: 152.) The OSHA standard for occupational exposure is 435 micrograms per cubic meter, as is the NIOSH recommendation for a 10-hour-a-day, 40 hour work week. (Patty's Toxicology, Chapter 47, Esther E. Sandmeyer, p. 3296, P. Exh. 21; *see also* NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, June 1994, Defendants' Exhibit A, p. 334-36.) Xylene is

a chemical that would not normally be found in a residential apartment, except in very low amounts. (Trans. [*31] IV: 148.) The concentrations of xylene found in Rhilinger's apartment on that day was almost sixty times the AAL and approximately 1.5 times the OSHA occupational limits. It is worth noting that because Rhilinger's exposure was in her home, rather than at work, her system did not always have the daily period inherent in typical work schedules for her body to clear itself of the solvents. An inability to clear chemicals from her system exacerbates their toxicity. (Trans. II: 134.) For unknown reasons, the amount present in the area outside the storage area was not determined.

In contrast, there was no toluene detected in the apartment on the testing day, and only a small amount, 25 micrograms per cubic meter, was found outside the storage area. The NIOSH recommended limit for toluene in an eight-hour workday is 375 micrograms per cubic meter. The AAL for 1,1,1,-tricholorethane is 1038.4 micrograms per cubic meter. (P. Exh. 12, p. 4.)

Finally, DGA used smoke tube testing to determine the air flow in the testing locations. (Trans. IV: 91.) This testing documented that Bernoulli's theory, or the "chimney effect" existed in the stairwell of the property. The chimney effect is, [*32] in essence, a natural draft that occurs in high, narrow areas such as chimneys, and stairwells. The higher the chimney or stairwell is, the more of a draft would be in effect and the more air would move through the area. (Trans. IV: 66-67.) This test showed that the air, and thus, any vapors it contained, were migrating from outside the storage area, up the stairs and into Rhilinger's apartment.

iii. David Gordon's Opinion

The testing conducted on October 15, 1991 was the only air quality test performed at the Property. After DGA completed its assessment and testing of the air quality in Rhilinger's apartment, Gordon wrote a report summarizing DGA's conclusions. (*See* P. Exh. J.) He concluded that the chemicals detected in Rhilinger's apartment, including the named VOCs, migrated from the storage area in the basement. (Trans. IV: 175-76.) Based on his assumption that the testing was conducted under nonaggressive conditions, he also suggested that the levels in the apartment while CCCI was a tenant, were typically in the range of five to fifteen times the levels found on the day of the testing. (Trans. IV: 91.) Gordon could not, however, tell the court, with precision, what [*33] the average level of toxicity present in the apartment would be over the relevant three-year period. (Trans. IV: 189-90.)

The results from one day of testing in a given location is an insufficient basis upon which an industrial hygienist could form an opinion about the likely average levels of VOCs present in that location over a three-year period. (Trans. IV: 184; 187-88.) Given a set of specific conditions, however, there are computer models or mathematical means of predicting the levels of toxicity on the basis of one day of results. (Trans. IV: 185.) These models allow for variation of the testing conditions. (Trans. IV: 185.) Gordon did not use any of these models in the Rhilinger case because of the many assumptions he would have been required to make (Trans. IV: 189), about which he did not have data. (*See* Trans. IV: 202.)

iv. DGA's Conclusion and the *Daubert* Standard.

Although during the hearing, defendants attempted to challenge every aspect of plaintiff's presentation, they did not seriously undermine the reliability of the methodology used and results obtained from the one day of air quality testing. Even if they did seriously dispute the reliability of [*34] the testing methodology, this court is satisfied that DGA used standard and scientifically reliable industrial hygiene practices in its air quality tests and assessments. It is typical for industrial hygienists to rely upon statements of lay witnesses as to their observations regarding air quality so that the correct tests can be administered. In addition, the actual tests were ones frequently used and relied upon in the industry. The machines used were sophisticated, designed for the purpose used, and there was no challenge to the accuracy of the results obtained. Finally, the so-called chimney effect is well documented and applicable in this case.

Nevertheless, this court agrees with the defendants' assertion that Gordon's extrapolation that the level of toxicity present in Rhilinger's apartment over the relevant three-year period was typically five to fifteen times the results obtained on October 15, 1991 is not scientifically reliable under *Daubert*.

Mr. Gordon, the plaintiff's own witness, admitted that without data about the variations in conditions in the tested area, it was scientifically indefensible to come to a conclusion regarding the probable levels of toxic [*35] substances over three-year period based on one day of testing. Gordon further stated that although he could have used scientific calculations or models to come to a reasoned conclusion, he did not do so in this case because he had no data about variations in conditions in the basement. [1]

1 Some of these variations include changes in temperature, whether the chemicals were used on the premises, how often the door from the basement to the outside were open, and how often the door from the basement to the stairwell were open.

Indeed, although plaintiff repeatedly asserted that the testing conditions were "best case," and not "aggres-

sive," she presented no evidence to that effect. There simply was no credible evidence as to how or when the chemicals, were used, if at all, on the premises. There was no credible evidence as to the typical hours that employees were on the premises. In short, there was no credible evidence as to what conditions were typical in the basement. Without such evidence, as plaintiff's [*36] own expert testified, no one could come to a reasoned and reliable conclusion as to the probable levels of toxicity in plaintiff's apartment over a three-year period. As Gordon stated, "that's just not something that [one] could do." (Trans. IV: 188.)

In addition, the data obtained on the one day of testing was, at best, ambiguous regarding the source and/or level on two out of the three named chemicals. This court concludes that in reaching his opinion regarding the probable range of toxicity, Gordon's methodology was highly speculative.

Even if the basis for Gordon's conclusion met the validation benchmark of *Daubert*, it is insufficiently tied to the facts of the case to be helpful to the trier of fact. *See Paoli supra.* Without evidence regarding the conditions in the basement and the use to which the chemicals were put while on the premises, Gordon's testimony is not of the informed quality and reliability necessary for this court to conclude that it would be helpful to a jury.

For these reasons, the court concludes that Gordon's testimony that the typical range of toxicity present in Rhilinger's apartment was five to fifteen times the levels measured on [*37] October 15, 1991 is scientifically unreliable under *Daubert*. This conclusion, however, does not preclude Gordon from testifying, as he did, about the testing and results obtained on October 15, 1991.

C. Clinical Evaluation

In addition to obtaining information regarding the patient's exposure history, the process of differential diagnosis requires the physician to form a list of causes consistent with the patient's reported symptoms. The physician then tests and examines the patient to both rule in and rule out possible causes of disease. (Trans. I: 103-04.)

Among the tests given to Rhilinger as part of this process, were the following: (1) thyroid function tests to rule out hypothyroidism; (2) a complete blood count to rule out anemia; (3) a full neurological exam to see if she exhibited the characteristics of brain diseases like stroke, tumor or lesions; (4) an examination to determine if she had other symptoms such as fever or weight loss that might indicate infectious disease like AIDS dementia or certain viral encephalitides; (5) a magnetic resonance imaging scan to rule out mid-stage Alzheimer's disease or Pick's disease; and (6) a SPECT brain scan to determine [*38] whether there was abnormal blood flow consistent with other patients with a reported chemical exposure history. (Trans. I: 130, 147-48.) In addition, a blood test was given to determine whether Rhilinger's blood showed the presence of elevated levels of chemicals. (P. Exh. 13.)

After conducting all these tests, and weighing the evidence as to their results, Dr. Hu concluded that there was no explanation consistent with Rhilinger's symptoms other than brain damage and chemical sensitivity due to chemical exposure. In addition, Dr. Hu opined that the source of the exposure was the chemicals stored in plaintiff's basement. Dr. Hu could identify no other source.

D. Dr. Hu's Opinion and the *Daubert* Standard

The decision for the court is whether Dr. Hu had a reliable and scientific basis for the opinion that Rhilinger suffered from TSE due to chronic exposure to chemical fumes from the solvents stored in the basement of her apartment building. The court has now concluded that Mr. Gordon's opinion as to the probable range of toxicity over the three-year period is scientifically unreliable. The next question is whether, based on all the other available evidence, Dr. Hu's diagnosis [*39] remains scientifically reliable.

In summary, the evidence shows the following: the presence of VOCs capable of causing brain damage in humans in plaintiff's apartment building; the presence in plaintiff's apartment, on October 15, 1991, of xylene at a level sixty times the recommended AAL and 1.5 times OSHA's recommended occupational levels; reports by plaintiff, her neighbor, and two inspectors of noticeable odors of chemicals in the apartment building; a citation for violation of local law by the Town of Weymouth Board of health for a nuisance due to the stored chemicals; one day of reliable testing showing the presence of the chimney effect in plaintiff's apartment building, causing the migration of air from the basement to the third floor; plaintiff's lack of other occupational or community chemical exposure history; plaintiff's reported symptoms consistent with TSE; results on numerous medical tests that ruled out other possible causes of the patient's reported symptoms; results of a blood test that showed elevated levels of VOCs including toluene and xylene; and results of a SPECT scan that showed abnormalities in brain flow consistent with other patients who reported exposure [*40] to chemicals.

The process of making a differential diagnosis is complex, especially in a case such as this. Without a test that can conclusively establish the plaintiff's injury, the physician must collect as much evidence as possible, weigh all the possible explanations for the patient's symptoms and come to his or her best medically sup-

ported conclusion as to their cause. Necessarily the process entails constant revision of the diagnosis by the physician as new evidence surfaces. *See In Re Paoli at 759*. Indeed, "sometimes a differential diagnosis can be reliable with less than full information . . ." *Id.*

This also means that the physician's opinion need not exclude every possible cause of the plaintiff's symptoms, but must be distinguished from mere guesses as to the probable cause. *Blanchard's Case, 277 Mass. 413, 415, 178 N.E. 606 (1931)*; *see also Monahan v. Economy Grocery Stores, 282 Mass. 548, 550, 185 N.E. 34 (1933)* . In this case, the opinion should show that the exposure to chemicals from the basement of Rhilinger's apartment was the "reasonably probable cause" of her condition. *Sheppard's Case, 287 Mass. 459, 463, 192 N.E. 4 (1934)*.

After [*41] reviewing the evidence, this court concludes that, even without relying on Gordon's opinion regarding the probable range of plaintiff's exposure over the relevant period, Dr. Hu had a sufficient basis on which to reliably conclude that Rhilinger suffered from TSE and that the source of her exposure was the chemicals stored in the basement of her apartment building. Dr. Hu satisfactorily ruled out competing explanations for Rhilinger's symptoms; took an extensive history of the patient, including an exposure history; subjected the patient to repeated tests; had multiple, reliable reports of chemical odors; had evidence of a violation of local nuisance laws; had evidence of the chimney effect and evidence of elevated levels of at least one VOC in the patient's apartment and blood. Indeed, Dr. Hu stated that even without David Gordon's opinion he still would have come to the same diagnosis. (Trans. III: 9.)

The art of differential diagnosis requires the exercise of sound medical judgment. The court concludes that based on the evidence presented, and despite the unreliability of Gordon's opinion, Dr. Hu's opinion, nevertheless, was based upon reasoned and reliable methodology. As [*42] to Dr. Hu's opinion testimony regarding plaintiff's diagnosis of TSE, Defendants' Motion in Limine to Exclude Testimony of Plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy, is DENIED.

ORDER

For the foregoing reasons, it is hereby ORDERED that

1) Defendant's Motion in Limine to Exclude Plaintiff's SPECT Scan and All Testimony Concerning the SPECT Scan (Docket No. 58a) is DENIED.

2) As to evidence of blood tests and testimony regarding blood testing, Defendants' Motion in Limine to Exclude Testimony of Plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy (Docket No. 74a) is DENIED.

3) As to David Gordon's testimony that the levels of chemicals typically present in plaintiff's apartment were five to fifteen times the levels recorded on October 15, 1991, Defendant's Motion in Limine to Exclude Testimony of Plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy (Docket No. 74a) is ALLOWED.

4) At the conclusion of the hearing, the court expressed the view orally that the plaintiff had failed to meet her burden of proof on the issue of the scientific reliability of the diagnosis of TSE. In light [*43] of the foregoing Memorandum of Decision, however, and in fairness to the defendants, the court is willing to allow defendants the opportunity to introduce additional evidence rebutting plaintiff's presentation on this issue.

Defendants shall notify the court no later than January 16, 1997 as to their intention to proceed on this matter. If no such notice is received by that date, the court ORDERS that, on all issues not disposed of in paragraphs (1)-(3), Defendant's Motion in Limine to Exclude Testimony of Plaintiff's Experts Regarding the Diagnosis of Toxic/Solvent Encephalopathy (Docket No. 74a) is DENIED.

5) To the extent that this court made previous oral rulings on the record that are inconsistent with these orders, those previous rulings are VACATED.

Julian T. Houston

Justice of the Superior Court

DATED: December 29, 1997