INDOOR AIR QUALITY ASSESSMENT

Hyannis West Elementary School
549 West Main Street
Hyannis, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
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Background/Introduction

At the request of the Barnstable Public Schools (BPS) and the Barnstable Teachers Association, the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health (BEH) provided assistance and consultation regarding indoor air quality (IAQ) concerns at the Hyannis West Elementary School (HWES) located at 549 West Main Street, Hyannis, Massachusetts. The primary health concern at the school was related to cancer, however in previous correspondence with HWES staff it was communicated that they also had concerns regarding general IAQ conditions.

On December 15, 2011, an assessment of the school was conducted by Cory Holmes, Environmental Analyst/Regional Inspector and Ruth Alfasso, Environmental Engineer/Inspector for BEH’s IAQ Program. BEH/IAQ staff were accompanied by Brenda Netreba, Environmental Analyst/Risk Communication Specialist in BEH’s Community Assessment Program (CAP) and Tony Lacina, Facilities Director, BPS.

The school is a single-story brick building that was constructed in 1963. Portable classrooms were reportedly added approximately 20-25 years ago. The main school building consists of general classrooms, offices, library, gymnasium, kitchen and cafeteria. The modular classrooms contain the art and music rooms, parent resource center and storage areas.

A number of upgrades have been made to the building over the years. The peaked asphalt-shingled roof was reportedly replaced and new window systems were installed approximately 10 years ago. More recently, the heating system was converted from #4 heating oil to natural gas. In addition, a new water-based resin gym floor was installed, and all sinks and cabinets in classrooms were replaced with one-piece molded countertops and cabinets.

Methods

Air tests for carbon dioxide, carbon monoxide, temperature and relative humidity were conducted with the TSI, Q-Trak, IAQ Monitor, Model 7565. Air tests for airborne particle matter with a diameter less than 2.5 micrometers were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. Screening for total volatile organic compounds (TVOCs) was conducted using a RAE Systems, MiniRae 2000™ Portable VOC Monitor PGM-7600 Photo-Ionization Detector (PID). BEH staff also performed a visual inspection of building materials for water damage and/or microbial growth.

Results

This HWES houses approximately 300 pre-kindergarten through grade 3 students and approximately 65 staff. Tests were taken under normal operating conditions and results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 parts per million (ppm) in 33 of 38 areas, indicating adequate air exchange in the majority of areas surveyed. Fresh air in classrooms is supplied by unit ventilators (univents) (Picture 1). A univent is designed to draw air from outdoors through a fresh air intake located on the exterior wall of the building (Picture 2). Return air is normally drawn through an air intake located at the base of each unit where fresh and return air are mixed, filtered, heated and provided to classrooms through an air diffuser located in the top of the unit (Figure 1). However, as reported by Mr. Lacina, the return vents have been blocked to maximize the intake of fresh outside air (Picture 3).

Univents are original to the building and are early 1960's vintage (~45-50 years old). According to the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), the service life[1] for a unit heater, hot water or steam is 20 years, assuming routine maintenance of the equipment (ASHRAE, 1991). Despite attempts to maintain the univents (e.g., oiling bearings, changing filters regularly), the operational lifespan of this equipment has been exceeded. Maintaining the balance of fresh to exhaust air will become more difficult as the equipment ages and as replacement parts become increasingly difficult to obtain.

To change univent filters HWES maintenance staff must remove a panel on the front of the unit, open a filter access panel and remove a metal frame to access the filter medium (Picture 4). The type of filter medium used by the school comes in a bulk roll and must be cut to size. This method is extremely time intensive and the results are variable; if the filter medium is not properly fitted, gaps can allow unfiltered air into the room and/or reduce the useful life of the filter. Disposable filters with a similar and appropriate dust spot efficiency can be installed in univents. The dust spot efficiency is the ability of a filter to remove particulates of a certain diameter from air passing through the filter. Filters that have been determined by ASHRAE to meet its standard for a dust spot efficiency of a minimum of 40% would be sufficient to reduce airborne particulates (MEHRC, 1997; ASHRAE, 1992). Note that increased filtration can reduce

[1] The service life is the median time during which a particular system or component of …[an HVAC]… system remains in its original service application and then is replaced. Replacement may occur for any reason, including, but not limited to, failure, general obsolescence, reduced reliability, excessive maintenance cost, and changed system requirements due to such influences as building characteristics or energy prices (ASHRAE, 1991).

reduce airflow produced by the AHU by increased resistance. Prior to any increase of filtration, each AHU should be evaluated by a ventilation engineer as to whether it can maintain function with more efficient filters. Univents were found obstructed by items such as chairs, tables, desks, and books in many classrooms. In order to function as designed, univents must be activated and allowed to operate free of obstructions and blockages.

Exhaust ventilation in classrooms is provided by exhaust vents located in closets (Picture 5). These vents are connected by ducts to rooftop fans that remove air from the building. At the time of the assessment, exhaust vents in classrooms 4 through 9 (Table 1) were not operating. Reportedly, ordered parts to repair the fans had not been delivered by the time of this visit. Without adequate air exchange, normally occurring pollutants can accumulate, leading to IAQ/comfort complaints.

In common areas of the building, such as the gymnasium and auditorium, mechanical supply and exhaust ventilation is provided by individual rooftop or ceiling-mounted air-handling units (AHUs). Fresh air is distributed via ceiling-mounted air diffusers and ducted back to AHUs via ceiling or wall-mounted return vents. No draw of air could be detected from the gymnasium exhaust vents indicating that this exhaust was deactivated. Each portable classroom also has an AHU mounted on the exterior wall and use wall-mounted air conditioners for cooling.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of school occupancy. In order to have proper ventilation with a univent and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). The date of last balancing of the ventilation systems reportedly occurred in 2004.

The Massachusetts Building Code requires that each area have a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (BOCA, 1993; SBBRS, 1997). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches (Appendix A).

Temperature readings ranged from 67 ºF to 78 ºF, which were within or close to the lower end of the MDPH comfort guidelines during the assessment (Table 1). The MDPH recommends that indoor air temperatures be maintained in a range between 70 ºF to 78 ºF in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

Relative humidity measurements ranged from 34 to 49 percent, with about half below the MDPH recommended comfort range during the assessment (Table 1). The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to be lower during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

At the time of assessment, school staff reported an active roof leak in the nurse’s office. Water-damaged acoustic ceiling tiles and walls were observed there and in a few other classrooms (Picture 6; Table 1). Water-damaged ceiling tiles indicate leaks from either the roof or plumbing system and can provide a source for mold growth. These tiles should be replaced after a water leak is discovered and repaired.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommends that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur. Water-damaged porous materials cannot be adequately cleaned to remove mold growth. The application of a mildewcide to moldy porous materials is not recommended.

Plants were observed in several areas, some of which were located on or directly adjacent to univents (Picture 7; Table 1). Plants should be properly maintained and equipped with washable drip pans. Plants should be located away from ventilation sources to prevent aerosolization and distribution of dirt, pollen or mold. Plants should also not be placed on porous materials (e.g., paper or cardboard), since water damage to porous materials may lead to microbial growth.

Paper products were stored beneath some sinks (Picture 8). Leaks from plumbing or condensation from pipes can moisten such porous materials. It was noted that the installation of the new sinks had not been fully completed at the time of the visit, and visible gaps between pipes and the wall existed. These breaches should be sealed to prevent migration of air, moisture and odors from between rooms and wall cavities. Dripping sinks were also observed in the custodian's area and the math lab bathroom. Sinks and areas beneath them should be monitored periodically for leaks, and leaks should be repaired promptly.

BEH staff examined the outside perimeter of the main building to identify breaches in the building envelope and/or other conditions that could provide a source of water penetration. Some exterior doors had light visible beneath them (Picture 9), indicating places where moisture and/or pests could enter the building. Weather-stripping should be used to eliminate visible gaps beneath doors.

Portable classrooms examined had numerous signs of damage and deterioration (Pictures 10 through 14). As previously mentioned, portable classrooms were added 20-25 years ago and as reported by BPS officials, were in used condition at the time they were installed. Based on reports as well as their present condition, it would indicate that they are being used far beyond their intended service life. Along the exterior, numerous breaches were noted to the underside, walls and along the roof edge of the portable classrooms (Pictures 10 through 13), which could allow pest entry or increased water damage leading to mold growth. Inside, the carpets were soiled and deteriorated, in some cases to a threadbare state (Picture 15). If these portable units are to continue to be in service, extensive renovations to both the interior and exterior are unwarranted. If the space is needed by the school, new units may be more feasible than much-needed repairs.

Other IAQ Evaluations

Indoor air quality can be negatively influenced by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants. Common combustion emissions include carbon monoxide, carbon dioxide, water vapor and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5) can produce immediate, acute health effects upon exposure. To determine whether combustion products were present in the indoor environment, BEH staff obtained measurements for carbon monoxide and PM2.5.

Carbon Monoxide

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). Exposure to carbon monoxide can produce immediate and acute health affects. Several air quality standards have been established to address carbon monoxide and prevent symptoms from exposure to these substances. The MDPH established a corrective action level concerning carbon monoxide in ice skating rinks that use fossil-fueled ice resurfacing equipment. If an operator of an indoor ice rink measures a carbon monoxide level over 30 ppm, taken 20 minutes after resurfacing within a rink, that operator must take actions to reduce carbon monoxide levels (MDPH, 1997).

The American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) has adopted the National Ambient Air Quality Standards (NAAQS) as one set of criteria for assessing indoor air quality and monitoring of fresh air introduced by HVAC systems (ASHRAE, 1989). The NAAQS are standards established by the US EPA to protect the public health from six criteria pollutants, including carbon monoxide and particulate matter (US EPA, 2006). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS levels (ASHRAE, 1989). The NAAQS were adopted by reference in the Building Officials & Code Administrators (BOCA) National Mechanical Code of 1993 (BOCA, 1993), which is now an HVAC standard included in the Massachusetts State Building Code (SBBRS, 1997). According to the NAAQS, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2006).

Carbon monoxide should not be present in a typical, indoor environment. If it *is* present, indoor carbon monoxide levels should be less than or equal to outdoor levels. Outdoor carbon monoxide concentrations were non-detect (ND) at the time of the assessment (Table 1). No measureable levels of carbon monoxide were detected inside the building during the assessment (Table 1).

Particulate Matter

The US EPA has established NAAQS limits for exposure to particulate matter. Particulate matter is airborne solids that can be irritating to the eyes, nose and throat. The

NAAQS originally established exposure limits to particulate matter with a diameter of 10 μm or less (PM10). According to the NAAQS, PM10 levels should not exceed 150 micrograms per cubic meter (μg/m^3) in a 24-hour average (US EPA, 2006). These standards were adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA established a more protective standard for fine airborne particles. This more stringent PM2.5 standard requires outdoor air particle levels be maintained below 35 μg/m^3 over a 24-hour average (US EPA, 2006). Although both the ASHRAE standard and BOCA Code adopted the PM10 standard for evaluating air quality, MDPH uses the more protective PM2.5 standard for evaluating airborne particulate matter concentrations in the indoor environment.

Outdoor PM2.5 concentrations the day of the assessment were measured at 6 μg/m^3 (Table 1). PM2.5 levels measured inside the building ranged from 6 to 16 μg/m^3 (Table 1), which were below the NAAQS PM2.5 level of 35 μg/m^3. Frequently, indoor air levels of particulates (including PM2.5) can be at higher levels than those measured outdoors. A number of activities that occur indoors and/or mechanical devices can generate particulate during normal operations. Sources of indoor airborne particulates may include but are not limited to particles generated during the operation of fan belts in the HVAC system, use of stoves and/or microwave ovens in kitchen areas; use of photocopiers, fax machines and computer printing devices; operation of an ordinary vacuum cleaner and heavy foot traffic indoors.

Building occupants expressed concerns over dark/black particles found near univent diffusers (Picture 16). As mentioned previously under “ventilation”, the metal univent filter racks examined were found to be corroded and disintegrating (Pictures 17 and 18). Due to the increased airflow through univents by sealing return vents, particles and debris are distributed on flat surfaces around univent air diffusers. Another possible source of this material may be from deteriorating fabric from the panels used to disable the return vents. While the particles are unsightly and require regular cleaning, no elevated levels of PM2.5 were found in locations where the particles were present. Therefore, it appears that the particles are too heavy to be a source of airborne (i.e., respirable) pollutants. If the change is made to use disposable univent filters and the interiors of univents and internal components are cleaned thoroughly, this issue should be resolved.

Volatile Organic Compounds

Indoor air can be greatly impacted by the use of products containing volatile organic compounds (VOCs). VOCs are carbon-containing substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total VOCs (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. In an effort to determine whether VOCs were present in the building, air monitoring for TVOCs was conducted. An outdoor air sample was taken for comparison. Outdoor TVOC concentrations were ND. No measureable levels of TVOCs were detected inside the building during the assessment (Table 1).

Please note, that the TVOC air measurements are only reflective of the indoor air concentrations present at the time of sampling. Indoor air concentrations can be greatly impacted by the use TVOC containing products. While no measureable levels of TVOCs were detected in the building during the assessment, materials containing VOCs were present in the school. BEH staff examined rooms for products containing these respiratory irritants.

Cleaning and sanitization products were observed in a number of rooms (Table 1; Pictures 8 and 19). These products contain chemicals that can be irritating to the eyes, nose and throat of sensitive individuals. Cleaning products should be properly labeled and stored in an area inaccessible to children. In addition, a Material Safety Data Sheets (MSDS) should be available at a central location for each product in the event of an emergency. Consideration should be given to providing teaching staff with school issued cleaning products and supplies to prevent any potential for adverse chemical interactions between residues left from cleaners used by the facilities staff and those left by cleaners brought in by others.

A specific concern was mentioned regarding earlier use of a VOC-containing floor cleaner in the gymnasium, which had reportedly resulted in symptoms. The material safety data sheet (MSDS) for this material was evaluated (Appendix B) and it was determined that the product is not a carcinogen. The use of this cleaner was reportedly discontinued prior to the MDPH visit.

A number of classrooms contained dry erase boards and related materials. Materials such as dry erase markers and dry erase board cleaners may contain VOCs such as methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve (Sanford, 1999), which can be irritating to the eyes, nose and throat.

The copy room contains several photocopiers and a lamination machine. This area is not equipped with local exhaust ventilation. Laminating machines and photocopiers can give off waste heat and irritating odors. VOCs and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. Ozone is a respiratory irritant (Schmidt Etkin, D., 1992).

Other Conditions

Other conditions that can affect indoor air quality were observed during the assessment. Accumulated dust, debris and cobwebs were also seen in several areas particularly along exterior walls, ceilings and windows (Table 1). In several classrooms, items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored in classrooms provides a source for dusts to accumulate. These items (e.g., papers, folders, boxes) make it difficult for custodial staff to clean. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up. In addition, these materials can accumulate on flat surfaces (e.g., desktops, shelving and carpets) in occupied areas and subsequently be re-aerosolized causing further irritation. In particular, consideration should be made in storage closets containing exhaust vents that the stored items do not block the operation of the exhaust system.

BEH staff observed chalk/dry erase board trays containing a build-up of chalk dust and whiteboard marker debris. These materials can be aerosolized by air movement from the ventilation system, doors opening and closing, and/or foot traffic and may present a respiratory irritant.

A number of fans/blades, exhaust vents and univent diffusers had accumulated dust/debris (Pictures 20 and 21). Fans should be cleaned periodically in order to prevent them from serving as a source of aerosolized particulates. Exhaust vents and univent diffusers should also be cleaned to prevent re-aerosolization of dust when equipment is activated.

Upholstered furniture, plush toys, and area carpets were observed in several classrooms (Picture 22; Table 1). It was reported that area rugs are brought in from home by teachers, so unknown allergenic constituents (e.g., cigarette smoke, pet dander) may be present. In addition, upholstered furniture is covered with fabrics that are exposed to human skin. This type of contact can leave oils, perspiration, hair and skin cells. Dust mites feed upon human skin cells and excrete waste products that contain allergens. In addition, if relative humidity levels increase above 60 percent, dust mites tend to proliferate (US EPA, 1992). In order to remove dust mites and other pollutants, frequent vacuuming of upholstered furniture is recommended (Berry, 1994). It is also recommended that upholstered furniture (if present in schools), be professionally cleaned on an annual basis. If an excessively dusty environment exists due to outdoor conditions or indoor activities (e.g., renovations), cleaning frequency should be increased (every six months) (IICRC, 2000).

Several aquariums were located in classrooms (Picture 23). Aquariums should be properly maintained to prevent bacterial/mold/algal growth and associated nuisance odors. An animal cage containing pet mice was observed in one classroom in close proximity to a univent air diffuser (Picture 24). Porous materials (i.e., wood shavings) can absorb animal wastes and can be a reservoir for mold and bacterial growth. Animal dander, fur and wastes can all be sources of respiratory irritants. Animals and animal cages should be cleaned regularly to avoid the aerosolization of allergenic materials and/or odors. These items should also be located away from the airstream of mechanical ventilation sources.

Finally, fluorescent light fixtures were missing covers in the staff room. Fixtures should be equipped with access covers installed with bulbs fully secured in their sockets. Breakage of glass can cause injuries and may release mercury and/or other hazardous compounds.

Health Concerns

At the request of the Barnstable Public Schools and the Barnstable Teachers Association, BEH staff attended a meeting on April 26, 2011 at the Barnstable School Administration Building and delivered a slide presentation on basic cancer facts and cancer epidemiology. During this meeting, additional concerns were raised about other health conditions and indoor air quality.

BEH staff conducted in-person interviews with interested HWES employees at the time of the IAQ inspection on December 15, 2011. The interviews included the administration of a questionnaire by BEH/CAP staff to obtain information on the type and frequency of symptoms experienced by some HWES employees. The questionnaire was closely modeled on surveys used previously by BEH as well as those used by the National Institute of Occupational Safety and Health (NIOSH) and the U.S. Environmental Protection Agency (US EPA). The questionnaire elicited information on specific symptoms that have been reported in the scientific/medical literature as commonly experienced by occupants of buildings with indoor air quality problems as well as information on perceived air quality and personal health factors. These types of questionnaires are used to systematically collect building-related health and environmental complaints. The information collected, in conjunction with the assessment of the indoor environment, can be used to evaluate possible associations between indoor air quality and health and to recommend appropriate follow-up, if warranted.

The HWES has an employee population of approximately 65 and seven individuals (11%) participated in the BEH interview. All responses were reviewed to identify the types of diseases and symptoms that were reported, their frequency of occurrence, and whether any unusual patterns emerged suggestive of a possible association with indoor environmental conditions in the HWES (Appendix C).

Employee Interview Results

Information from the seven individuals is summarized below. Under both state and federal regulations, personally-identifying information shared by employees is confidential; therefore, the following discussion provides summary information only.

Health Effects

Of the 7 employees interviewed, all were female. The average age of the employees was approximately 51 years old and the average length of employment with HWES was 16 years. Smoking status was obtained in the interviews due to the role of smoking in respiratory health. Among the 7 employees, four reported that they have never smoked and three reported that they are former smokers.

The most commonly reported symptoms (with at least 5 of the 7 employees reporting that they experienced the symptom at least once in the last four weeks) were: stuffy or runny nose, or sinus congestion not related to an infection; sore, hoarse or dry throat; skin irritation, dryness, redness, or rash; pain or stiffness in the back, shoulders or neck; and headaches. Just over half of these seven employees reported that their symptoms were more severe while inside the building. Other symptoms that were reported by at least three of the 7 employees to have been experienced at least once in the last four weeks included the following: coughing; dry, itching, burning, watering or irritated eyes; and unusual tiredness, fatigue or drowsiness. Respondents were asked if there was a particular time of day or week when their symptoms usually became worse or occurred more frequently; most employees reported no pattern during the week but symptoms occurred most often or were worse predominantly in the afternoon.

Employees who participated in the MDPH interview were also asked if they have ever been diagnosed by a doctor with any of the following conditions: asthma, eczema, hay fever/allergies, or migraine headaches. Of the 7 participating employees, five reported being diagnosed with hay fever/allergies, three with asthma, three with eczema, and two with migraine headaches. All of the individuals with a reported diagnosis of hay fever/allergies, asthma, or eczema reported to MDPH that they had been diagnosed with their condition prior to working at HWES. One individual who reported a diagnosis of migraine headaches also reported that they were diagnosed prior to starting at HWES.

When individuals who participated in the interviews were asked if they had any other health related concerns at the HWES that had not yet been discussed, two of the seven mentioned general concerns about the incidence of cancer among current and former staff at the HWES and one individual raised specific concerns about the incidence of breast cancer. The incidence of Guillain-Barre syndrome over a 20-year period was also mentioned by one individual. A few other specific health conditions of concern were reported; however, these conditions do not appear to be related to one another, having different risk factors and/or etiologies, and are not discussed further in order to protect confidentiality.

Building Concerns

The seven HWES employees were also asked about their perceptions of environmental conditions in their work environment. Responses that were reported by at least 4 of the employees were as follows:

- 7 reported that the air was too dry
- 5 reported unusual or unpleasant dusts
- 5 reported chemical odors (e.g., paint, cleaning fluids, etc.)
- 5 commented on the general cleanliness of the building
- 4 reported that the air was too stuffy

Other responses that were reported include musty or mold odors (3 respondents), other unusual or unpleasant odors (2), vehicle exhaust odor (1), and air that is too humid (1). Of the 7 employees surveyed, four reported that the indoor temperature was consistently too hot, while three individual reported that it was consistently too cold. When participants were asked if they had any additional building related concerns at the HWES that had not yet been discussed, one individual mentioned a concern about the quality of the drinking water, which was reported to be discolored at times.

Symptomology and Building Location

The locations where individuals reported working in the building and their health concerns were evaluated with respect to the results from the environmental testing conducted by BEH/IAQ staff. All seven employees reported that there were specific locations within the HWES where they spend the majority of their time. Six individuals reported working primarily in one location throughout the course of a given school day and one individual reported working in more than one location throughout the typical workday.

As previously mentioned, carbon dioxide levels ranged from about 390 ppm to 1440 ppm in the HWES. Carbon dioxide measurements were available for all of the rooms reported as a work space by an HWES employee. Of the rooms reported as a work location by the 7 individuals interviewed, only one had carbon dioxide levels above the recommended 800 ppm. Temperature and relative humidity levels were also available for all of the rooms reported as a work space by an HWES employee. Slightly more than half of the rooms used by the 7 individuals had relative humidity levels below the recommended range of 40 – 60%. Temperatures in all of these areas were consistent with IAQ comfort guidelines.

Conclusions/Recommendations

Health Discussion/Conclusions

The respiratory/irritant and other symptoms reported among participants in this health investigation are generally those most commonly experienced in buildings with indoor air quality problems. These included stuffy or runny nose or sinus congestion not related to an infection; sore, hoarse or dry throat; headaches; and unusual tiredness, fatigue or drowsiness. Such symptoms are commonly associated with ventilation problems in buildings, although other factors (e.g., odors, microbiological contamination) may also contribute (Passarelli, 2009; Norbäck, 2009; Burge, 2004; Stolwijk et al., 1991).

During BEH’s inspection on December 15, 2011, carbon dioxide was found below 800 ppm in 33 of the 38 test sites. As mentioned, carbon dioxide is not a problem in and of itself; however, it is used as an indicator of the adequacy of the fresh air supply.

Five of the 7 individuals who participated in the survey reported having hay fever/allergies. The onset of allergic reactions to mold/moisture can be either immediate or delayed. Allergic responses include hay fever-type symptoms such as runny nose and red eyes. All of the individuals were diagnosed with hay fever/allergies prior to working at the HWES;

however, exposure to irritants (e.g., mold/moisture, dust) as well as low relative humidity environments can exacerbate pre-existing allergy symptoms. It is likely that some individuals with pre-existing symptoms may be impacted differently than the general population.

Cancer and Other Health Concerns

As mentioned previously, the incidence of cancer among current and former employees of the HWES was a concern to some of those interviewed. According to the American Cancer Society, cancer is the second leading cause of death in Massachusetts and the United States. Not only will one out of three women and one out of two men develop cancer in their lifetime, but cancer will affect three out of every four families. For this reason, cancers often appear to occur in “clusters,” and it is understandable that someone may perceive that there are an unusually high number of cancer cases in their neighborhood, workplace or town. Upon close examination, many of these “clusters” are not unusual increases, as first thought, but are related to such factors as local population density, variations in reporting, or chance fluctuations in occurrence. In other instances, the “cluster” in question includes a high concentration of individuals who possess related behaviors or risk factors for cancer. Some, however, are unusual; that is, they represent a true excess of cancer in a workplace, a community, or among a subgroup of people. A suspected cluster is more likely to be a true cancer cluster if it involves a high number of diagnoses of one type of cancer in a relatively short time period rather than several different types diagnosed over a long period of time (i.e., 20 years), a rare type of cancer rather than common types, and/or a large number of diagnoses among individuals in age groups not usually affected by that cancer. These types of clusters may warrant further public health investigation.

The Massachusetts Cancer Registry (MCR) a division in the MDPH Bureau of Health Information, Statistics, Research, and Evaluation, is a population-based surveillance system that that has been monitoring cancer incidence in the Commonwealth since 1982. All new diagnoses of invasive cancer, along with several types of in situ (localized) cancer, occurring among Massachusetts residents are required by law to be reported to the MCR within six months of the date of diagnosis (M.G.L. c.111. s 111b). This information is collected and kept in a confidential database. Data are collected on a daily basis and reviewed for accuracy and completeness on an annual basis. Individuals diagnosed with cancer in Massachusetts are reported to the MCR based on their residence at diagnosis and not their workplace. For that reason, calculating an expected rate of cancer is difficult at best for a place of employment, such as a school. The most practical first step in evaluating cancer in the workplace is to determine the types of cancer reported and whether they represent an unusual pattern (i.e., are the cancers reported the same type and/or are they rare cancers?).

In Massachusetts, breast cancer has been the most common type of cancer diagnosed among female residents for more than a decade and prostate cancer has been the most common type diagnosed among male residents. Each of these cancer types accounts for approximately 28% of new cancers diagnosed among females and males statewide, respectively, during 2004-2008. Lung and bronchus cancers have been the second most common type of cancer diagnosed among both males and females in Massachusetts and account for approximately 14% of new cancers statewide during 2004-2008. Colorectal cancers are the third most common type of cancers diagnosed among males and females and account for approximately 10% of new cancers in Massachusetts during this time period.

It should be noted that because a school's workforce is often primarily composed of women, it is not unusual for breast cancer to be the most frequently diagnosed cancer type in the school population. The chance of developing invasive breast cancer at some time in a woman's life is about 1 in 8 (12%). A woman's risk of developing breast cancer increases with age, with age being the strongest risk factor for breast cancer. About 1 out of 8 invasive breast cancers are found in women younger than 45, while about 2 out of 3 are found in women age 55 or older (ACS 2012). Several studies have found that women who work in professional jobs, including teachers, tend to have an increased risk of developing breast cancer (Ruben et al. 1993; Threlfall et al., 1985; MacArthur et al., 2007; King et al., 1994; Pollan and Gustavsson, 1999) while other studies have not (Calle et al., 1998; Petralia et al., 1999). No occupational exposures have been identified in these studies. Rather, researchers suspect that established risk factors for breast cancer such as later maternal age at first birth and lower parity (the number of times a woman has given birth) may be more prevalent in women working in a professional setting than in women who do not (such as homemakers). Women with more education are also more likely to undergo regular mammograms, increasing the likelihood of earlier detection for breast cancer (NIOSH 2010). A more detailed discussion of breast cancer risk factors can be found in Appendix D.

Guillain-Barre syndrome is an autoimmune disorder in which the body's immune system attacks part of the peripheral nervous system. Although the exact cause of Guillain-Barre syndrome is unknown, it often follows a minor infection, such as lung infection or gastrointestinal infection. It also may occur along with viral infections or other medical conditions such as systemic lupus erythematosus or Hodgkin's disease. The syndrome is rare, occurring in about one person in 100,000. It may occur at any age, but is most common in people between ages 30 and 50 (NINDS, 2011; USNLM, 2010).

Water Quality Concerns

To address concern about the quality of drinking water at the HWES, CAP staff reviewed the 2009 Consumer Confidence Report, which is required to be provided to community residents by federal law. Its purpose is to inform residents about the quality of their municipal drinking water. The water for the Hyannis Water System is obtained from 11 groundwater wells located in the town of Barnstable. It is possible that the discoloration of the water at the HWES that was reported may be due to elevated levels of iron and manganese. Both are naturally occurring minerals in the environment and essential nutrients in our food but can make water a rusty or yellow color. In addition, elevated levels of zinc could affect the taste of the water (Hyannis Water System 2010).

Other exceedances that were noted include total coliform bacteria and sodium. Total coliform bacteria were found in more samples than are allowed in a month. These bacteria are naturally present in the environment and are used as an indicator that other potentially harmful bacteria may be present. Subsequently, the treatment process was updated to improve the application of chlorine for disinfection.

The maximum concentration of sodium detected (30 ppm) exceeds the Massachusetts guideline for sodium in drinking water of 20 ppm. Sodium is a naturally occurring element found in water and soil. It is an essential nutrient, necessary for the normal functioning of the body and maintenance of body fluids. The Massachusetts guideline represents a level of sodium in water that physicians and sodium-sensitive individuals should be aware of in cases where sodium exposures are carefully controlled. People who have difficulty regulating fluid volume as a result of several diseases such as hypertension and kidney failure are particularly affected by elevated levels of sodium (MDPH 2007). MDPH's fact sheet on sodium in drinking water is included in Appendix E.

IAQ Conclusions

In view of the findings at the time of this visit, recommendations are made concerning the general school building as well as portable classrooms at the school.

General/School-wide Recommendations

1. Operate all ventilation systems (e.g., AHUs and univents) throughout the building continuously during occupied periods.
2. Continue with plans to make repairs to exhaust vents that are on the repair list. Ensure classroom exhaust vents are operating at the start of school and are allowed to operate during occupancy.
3. Consult with an HVAC engineering firm regarding the feasibility of repair vs. replacement of ventilation system components (e.g., univents and AHUs) given their age/condition.
4. Remove all blockages from univents and exhaust vents to ensure adequate airflow.
5. Encourage the closing of classroom doors during occupied periods to facilitate air exchange.
6. Replace metal filter racks with proper fitting disposable filters with an equal or greater dust-spot efficiency to eliminate the time needed to replace filters from bulk material

rolls. Prior to any increase of filtration, each piece of air handling equipment should be evaluated by a ventilation engineer as to whether it can maintain function with more efficient filters.

7. Ensure exhaust vents and the interiors of univent cabinets are thoroughly cleaned of dirt, dust and loose debris on a regular basis (e.g., during regular filter changes).
8. Inspect the fabric material installed on univent return vents for breakdown/integrity, replace as necessary.
9. Consider adopting a balancing schedule of every 5 years for all mechanical ventilation systems, as recommended by ventilation industrial standards (SMACNA, 1994).
10. Use openable windows in conjunction with mechanical ventilation to facilitate air exchange during periods of mild weather. Care should be taken to ensure windows are properly closed at night and weekends to avoid the freezing of pipes and potential flooding.
11. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
12. Ensure any roof/plumbing leaks are repaired and replace water-damaged ceiling tiles (e.g., nurse’s office). Examine the area above and around these areas for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.

13. Eliminate spaces around exterior doors. Ensure door fits flush with threshold. Seal doors on all sides with foam tape and/or weather-stripping. Ensure tightness of doors by monitoring for light penetration and drafts around doorframes.

14. Seal holes/gaps between pipes and walls beneath sink countertops (if not already completed) to prevent migration of air, moisture and odors from between rooms and wall cavities.

15. Make repairs to sinks in the custodian's area and the math lab bathroom.

16. Examine the feasibility of installing local exhaust ventilation in copy room to remove excess heat, odors and airborne pollutants generated by photocopiers and lamination machines. If not feasible consider relocating to well-ventilated area.

17. Clean existing carpeting annually (or semi-annually in soiled high traffic areas) as per recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC). Copies of the IICRC fact sheet can be downloaded at: http://www.certifiedcleaners.org/faq.shtml (IICRC, 2005)

18. Clean plush toys, upholstered furniture and area rugs frequently to remove dust and dust mites. Consider purchasing new area rugs to replace those brought in from outside.

19. Move plants away from univents in classrooms. Ensure all plants are equipped with drip pans. Examine drip pans for mold growth and disinfect areas of water leaks with an appropriate antimicrobial where necessary.

20. Clean and maintain aquariums to prevent bacterial/microbial growth and associated odors.

21. Clean animal cages regularly and ensure they are not in the airstream of univents.

22. Store cleaning products properly and out of reach of students. Ensure spray bottles are properly labeled and that Meds are available for each product. Consider providing standard school-issued cleaning products to staff.
23. Clean accumulated chalk dust and dry erase marker debris on a regular basis.
24. Consider developing a written notification system for building occupants to report indoor air quality issues/problems. Have these concerns relayed to the maintenance department/ building management in a manner that allows for a timely remediation of the problem.
25. Relocate or consider reducing the amount of materials stored in classrooms to allow for more thorough cleaning of classrooms. Clean items, including chalk trays, pencil shaving trays and dry erase marker trays regularly with a wet cloth or sponge to prevent excessive dust build-up.
26. Clean personal fans, univent air diffusers, return vents and exhaust vents periodically of accumulated dust.
27. Clean/change filters for window-mounted ACs as recommended by the manufacture.
28. Replace missing covers for fluorescent light fixtures (e.g., staff room).
29. Consider adopting the US EPA (2000) document, "Tools for Schools", to maintain a good indoor air quality environment on the building. This document can be downloaded from the Internet at: http://www.epa.gov/iaq/schools/index.html.
30. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. These materials are located on the MDPH's website: http://mass.gov/dph/iaq.

Portable Classroom Recommendations

If portable classrooms are intended for future, long-term use, the following recommendations should be considered, the majority of which will require alteration to the building structure and equipment.

1. Remove/replace deteriorated/water-damaged wooden siding. Due to the scope of damage and lack of or possible damage to insulation, exterior walls should be examined and replaced as necessary.
2. Make repairs to roof flashing to prevent water infiltration behind wooden siding.
3. Install gutters and downspouts to drain water away from building.
4. Repair/replace damaged aluminum skirt (Picture 13), to prevent entry by animals/rodents/pests.
5. Replace worn/damaged carpeting.
6. Due to the age and condition of HVAC units, AHUs should be evaluated by an HVAC engineering firm for proper operation and repaired/replaced as needed.
7. Ensure AHUs are outfitted with proper filters. Change filters for AHUs as per manufacturer's instructions or more frequently if needed. Clean interiors of AHUs during each filter change.
8. Repair and/or replace windows that are in disrepair.
9. Repair/replace warped/damaged doors/frames. Seal doors on all sides with foam tape and/or weather-stripping. Ensure tightness of doors by monitoring for light penetration and drafts around doorframes.
10. Monitor for water penetration once repairs are made. Report any signs of water damage/penetration to building maintenance/management for prompt remediation.

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Picture 1

1960's Vintage Univent

Picture 2

Univent Fresh Air Intakes

Picture 3

Univent Return Vent Blocked by Fabric Material (Arrow)

Picture 4

Metal Frame/Rack Containing Cut-to-Size Filter Material, Note Deterioration/Corrosion of Frame

Picture 5

Exhaust Vent Located in Classroom Closet with Folding Doors

Picture 6

Water-Damaged Ceiling Tiles in the Nurse's Office

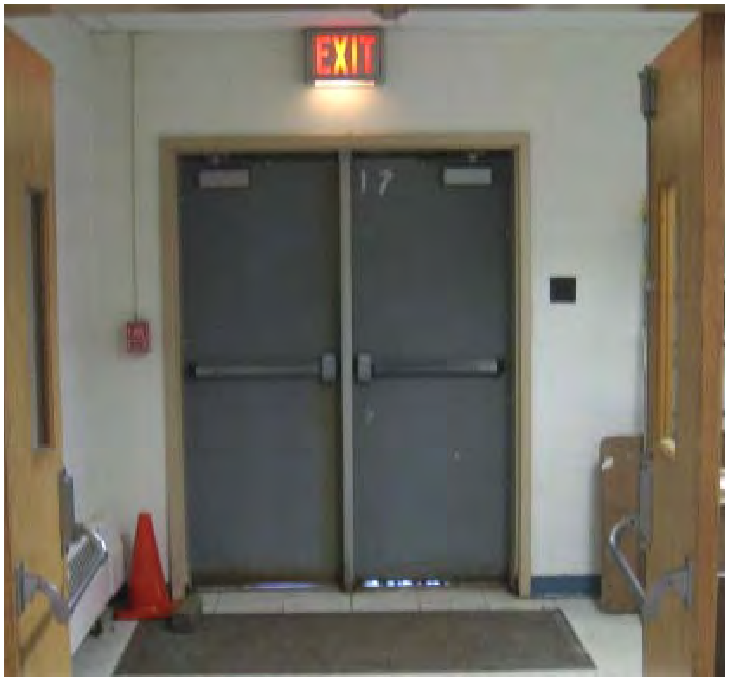
Picture 7

Plants on Univent Adjacent to Air Diffusers

Picture 8

Porous Materials and Cleaning Products Stored under Sink

Picture 9



Light Visible beneath Hallway Door Showing Potential Entry for Moisture and Pests

Picture 10

Damaged Wooden Siding on Portable Classroom

Picture 11

Damaged Wooden Siding on Portable Classroom

Picture 12

Damaged Exterior of Portable Classroom

Picture 13

Damaged Exterior of Portable Classroom

Picture 14

Window and Water-related Damage in Portable Classroom

Picture 15

Damaged Carpeting in Portable Classroom

Picture 16

Black Particles near Univents, Likely from the Deterioration of Rusted Metal Univent Filter Racks

Picture 17

Severely Corroded and Damaged Metal Univent Filter Rack

Picture 18

Black/Dark Debris and Loose Pieces of Metal from Univent Filter Rack

Picture 19

Cleaning Products under Sink

Picture 20

Dusty Exhaust Vent in Classroom Closet

Picture 21

Personal Fan with Dusty Blades

Picture 22

Plush Toys in Classroom

Picture 23

Aquarium in Classroom

Picture 24

Pet Mice in Cage near Univent Air Diffuser

Location: Barnstable Hyannis West Elementary School **Indoor Air Results**

Address: 549 West Main Street, Hyannis **Date: 12/15/2011**

Table 1

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Background		55	82	320	ND	ND	6				Breezy, damp, light rain
Counselor's room	8	72	43	1280	ND	ND	13	Y	N	N	DO, markers
Math lab (right, Mrs. Thomas)	0	72	42	534	ND	ND	10	Y	Y	Y off	Ducted UV, DEM, leaking sink in attached bathroom
Math lab (computer lab)	18	75	41	590	ND	ND	10	Y	Y	Y off	Ducted UV, 9 computers, DEM
Custodian	0	76	36	480	ND	ND	10	Y open	N	Y switch activated	Attached bathroom used for storage, leaking sink in bathroom
P2 (music)	20	67	42	850	ND	ND	9	Y recently open	Y	Y	CD, DEM, damaged/deteriorated carpeting
P1 (reading resource)	2	68	44	735	ND	ND	9	Y	Y	Y	DEM, damaged/deteriorated carpeting
P4, Elias's corner	1	72	40	570	ND	ND	15	Y	Y	Y	DEM, CD, slightly deteriorated carpet
Gym	0	68	49	615	ND	ND	16	Y	Y	Y off	Gym floor is new, ceiling fan on

ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter
ND = non detect
AC = air conditioner
Aqua = aquarium
CD = chalk dust
CP = cleaning products
CT = ceiling tile
DEM = dry erase materials
DO = door open
PC = photocopier
PF = personal fan
TB = tennis balls
TVOCs = total volatile organic compounds
UV = univent
WD = water-damaged

Comfort Guidelines

Carbon Dioxide:	< 600 ppm = preferred	Temperature:	70 - 78 °F
	600 - 800 ppm = acceptable	Relative Humidity:	40 - 60%
	> 800 ppm = indicative of ventilation problems	Particle matter 2.5	< 35 ug/m^3

Location: Barnstable Hyannis West Elementary School **Indoor Air Results**

Address: 549 West Main Street, Hyannis **Date: 12/15/2011**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Therapy Room	1	78	40	578	ND	ND	8	Y	Y	Y	
Restroom										Y	Cobwebs
Copy room	0	74	37	691	ND	ND	10	N	N	N	PCs/laminator
Staff room	4	74	38	768	ND	ND	10	Y	N	N	Missing light cover
Computer lab	11	73	38	1140	ND	ND	14	Y	N	N	PF
Main office	1	73	37	691	ND	ND	11	Y	N	N	
Nurse office	1	74	38	795	ND	ND	11	Y	N	Y	RR Exhaust not on, 3 WD CT (Active leaks reported)
Principal's Office	1	72	35	643	ND	ND	10	Y	N	N	
Cafeteria	~60	73	43	688	ND	ND	13	Y	1 of 4 on	Unit exhaust off	Space/light under exterior doors, DO

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Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 (µg/m³)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Faculty restroom								N	Y passive	Y off	
Prev Spec Office	2	74	38	720	ND	ND	8	N	Y passive	N	Plant, heater, DO, area rugs
Girls restroom										Y	CP
1	1	74	38	482	ND	ND	8	Y	Y	Y off	DEM, plants, toaster, food, CP under sink
2	0	73	38	434	ND	ND	10	Y	Y	Y off	Paper under sink, items on UV, PF, plants, food
3	1	73	37	691	ND	ND	6	Y	Y	Y grill missing	Duct tape on UV, PF, markers, CD
Portable 4 (parent center)	3	71	41	575	ND	ND	10	Y	Y	Y	Microwave (in use), 4 window ACs

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Particle matter 2.5 < 35 ug/m³

Location: Barnstable Hyannis West Elementary School **Indoor Air Results**

Address: 549 West Main Street, Hyannis **Date: 12/15/2011**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
4	15	70	43	504	ND	ND	13	Y	Y	Y off	Pillows on floor, UV interior examined, metal mesh filter racks rusted and decomposed, UV return vent blocked, other interior metal UV components rusty
5	0	72	38	425	ND	ND	10	Y open	Y	Y off	Occupants at lunch, TB, CD, CP under sink
6	18	70	43	547	ND	ND	12	Y	Y	Y off	Dust/dirty/debris, DEM (window sill)
7	0	71	39	392	ND	ND	10	Y	Y	Y off	Cobwebs accumulated items
8	19	72	44	1441	ND	ND	13	Y	Y	Y off	Items in front of UV, exhaust dusty, CP under sink, PS
9	17	72	41	622	ND	ND	10	Y	Y	Y off	PF dusty, items hanging from CTs
10	11	73	40	601	ND	ND	10	Y	Y	Y	DO, area rug

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Location: Barnstable Hyannis West Elementary School **Indoor Air Results**

Address: 549 West Main Street, Hyannis **Date: 12/15/2011**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 ($\mu g/m^3$)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
11	5	75	34	627	ND	ND	15	Y	Y	Y	UV off (reported too hot), 4 WD-CT 1 bowed CT
12	17	71	40	677	ND	ND	9	Y	Y	Y	PF – dusty, CP under sink, 3 WD CT, DO, Plant on UV
13 (library)	1	70	40	389	ND	ND	7	Y	Y	Y	CP under sink
14	12	71	39	594	ND	ND	9	Y	Y	Y	Plant, DEM, paper and CP under sink, DO
15	18	70	40	919	ND	ND	9	Y	Y	Y	Area rug, pillows, UV on low, paper under sink
16	12	71	38	545	ND	ND	12	Y	Y	Y	Items on UV, cobwebs on window/ceiling, bowed CT
17	22	72	41	756	ND	ND	11	Y	Y	Y	Area rugs, DO
18	21	70	40	694	ND	ND	12	Y	Y	Y	CP, UV off
19	21	74	36	740	ND	ND	10	Y	Y blocked	Y	Aqua, PF, CP under sink, DEM

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Address: 549 West Main Street, Hyannis **Date: 12/15/2011**

Table 1 (continued)

Location/ Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	TVOCs (*ppm)	PM2.5 (μg/m^3)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
20	1	73	37	692	ND	ND	10	Y	Y	Y	20 occupants 15 minutes before, CP, DEM

ppm = parts per million
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Appendix B

MATERIAL SAFETY DATA SHEET

PULASTIC MAT

Descol Sports Surfaces

HMIS

HEALTH	1
FLAMMABILITY	1
REACTIVITY	0
PERSONAL PROTECTION	D

1. Product And Company Identification

Supplier
B.V. DESCOL KUNSTSTOF CHEMIE
Duurstedeweg 33007
7418 CK-DEVENTER, The Netherlands
Company Contact: tqm@descol.nl
Telephone Number: + 31 (0) 570 620744
Fax Number: + 31 (0) 570 628553

Manufacturer
B.V. DESCOL KUNSTSTOF CHEMIE
Duurstedeweg 33007
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Supplier Emergency Contacts & Phone Number

International: + 31 570 854 201

Manufacturer Emergency Contacts & Phone Number

International: + 31 570 854 201

Issue Date:	24/10/2005
Product Name:	PULASTIC MAT
Chemical Formula:	Mixture of detergents, alcohol, ether and naphta in water
Chemical Family:	Aqueous solution of surfactant and solvents
MSDS Number:	U/PUMAT
Product Code:	-

2. Composition/Information On Ingredients

Ingredient Name	CAS Number	Percent Of Total Weight
Isopropanol	67-63-0	< 3
Diethylene glycol monoethylether	111-90-0	< 4
Naphta-Benzonefree	64742-81-1P	< 3

3. Hazards Identification

Eye Hazards:	May cause irritation.
Skin Hazards:	May cause irritation.
Ingestion Hazards:	May cause health disorders
Inhalation Hazards:	May cause irritation

Appendix B

MATERIAL SAFETY DATA SHEET

PULASTIC MAT

Sika® Descol Sports Surfaces

4. First Aid Measures	
Eye:	In case of contact, immediately flush eyes with separated eyelids with plenty of water for at least 15 minutes. Get medical attention immediately if irritation develops and persists.
Skin:	In case of contact with skin wash off immediately with soap and water. Consult a doctor if skin irritation persists.
Ingestion:	If swallowed, do not induce vomiting (irritating nature of the compound) unless directed to do so by medical personnel.
Inhalation:	In the event of symptoms take medical treatment.

5. Fire Fighting Measures	
Flash Point:	Not applicable
Auto ignition Point:	Not applicable
Flammability Class:	N/AV
Lower Explosive Limit:	N/AV
Upper Explosive Limit:	N/AV
Fire and Explosion Hazards:	Avoid extreme heat of closed containers. Containers may explode by pressure.
Extinguishing Media:	Compatible with all usual extenguishing media
Fire Fighting Instructions:	Fire fighters should wear self-contained breathing apparatus and full protective gear.

6. Accidental Release Measures	
Personal precautions:	Ensure adequate ventilation. Use protective clothing. Use breathing apparatus if exposed to vapours/dust/aerosol.
Environmental precautions:	Do not allow to enter drains of waterways. In case of entry into waterways, soil of drains, inform the responsible authorities.
Procedures for cleaning up:	Pick up with absorbent material (e.g. sand, sawdust, general-purpose binder)

7. Handling And Storage

Handling And Storage Precautions:

Till the moment of use, keep containers tightly closed. Keep out of reach of children. Use only with adequate ventilation.
Avoid contact with eyes. Avoid contact with skin and clothing.
Use only with adequate personal protection. Wash thoroughly with soap and water after handing.

Storage Precautions:

Between - 32 °F (0 °C) and 122 °F (50 °C). Ideal storage temperature: 59 – 77 °F (15 – 25 °C).

8. Exposure Controls/Personal Protection	
Engineering Controls:	Use with adequate general and local exhaust ventilation
Eye/Face Protection:	Safety glasses. When there is a greater risk of splash
Skin Protection:	Depending on use, cover exposed skin as much as possible with appropriate clothing and gloves.
Respiratory Protection:	Not applicable
Ingredient(s) – Exposure Limits:	None

Appendix B

MATERIAL SAFETY DATA SHEET

Descol Sports Surfaces

PULASTIC MAT

9. Physical And Chemical Properties	
Appearance:	Clear green liquid
Odor:	Pleasant
Chemical Type:	Mixture
Physical State:	Liquid
Melting Point:	32 °F, (0 °C)
Boiling Range	176 – 212 °F, (80-100 °C)
Specific Gravity:	1.03
Percent Volatiles:	-
Percent VOC's:	5 - 10 %
Packing Density:	-
pH Factor:	7.5 – 8.5, 68 °F (20 °C).
Vapor Pressure:	N/AV
Solubility:	Miscible
Viscosity:	< 100 mPa.s.(20 °C)
Evaporation Rate:	N/AV

10. Stability and Reactivity	
Stability:	Stable
Hazardous Polymerization:	Will not occur
Conditions To Avoid (Stability):	Protect from heat and direct sunlight. Protect from atmospheric moisture and water.
Incompatible Materials:	Not applicable
Hazardous Decomposition Products	No decomposition if used as prescribed.
Conditions To Avoid (Polymerization):	Not applicable

11. Toxicological Information	
Conditions Aggravated By Exposure:	None
Ingredient(s) – Carginogenicity:	None
Ingredient(s) – Mutagenicity:	None

12. Ecological Information

General Notes:
Do not allow material to be released to the environment without proper governmental permits.

13. Disposal Considerations

Dispose in accordance with applicable federal, state and local government regulations.
Incineration is the prefered method.
Empty containers retain product residue (liquid and vapor) and can be dangerous.
Do not heat or cut such containers with electric or gas torch because highly toxic vapors and gases are formed.

14. Transport Information	
DOT (DOMESTIC SURFACE)	
Proper Shipping Name:	
Hazards Class:	Not regulated
IMO/IMDG CODE (OCEAN):	Not regulated
ICAO/IATA (AIR):	Not regulated

Appendix B

MATERIAL SAFETY DATA SHEET

PULASTIC MAT

Descol Sports Surfaces

15. Regulatory Information

U.S. Regulatory Information
All ingredients of this product are listed or are excluded from listing under the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

SARA TITLE III:

SARA Section 302
This product contains no extremely hazardous substances.

SARA Section 311/312
Non-hazardous.

SARA - Section 313
Glycolethers

Ingredient(s) – U.S. Regulatory Information
Non-hazardous ingredients

Ingredient(s) – State Regulations
None

CALIFORNIA PROPOSITION 65
To the best of our knowledge, this product contains no levels of listed substances, which the state of California has found to cause cancer, birth defects or other reproductive effects.

MASSACHUSETTS SUBSTANCE LIST (MSL)
Hazardous Substances and Extraordinarily Hazardous Substances on the MSL must be identified when present in products. To the best of our knowledge, this product contains no substances at a level which could require reporting under the statute.

16. Other Information

HMIS Rating
Health: 1
Fire: 1
Reactivity: 0
PPE: D

Revision/Preparer Information
MSDS Preparer: JACOB PILON
This MSDS supercedes A Previous MSDS Dated: not applicable

Disclaimer

The data in this Material Safety Data Sheet relates only to the specific material herein and does not relate to use in combination with any other material or in any process. The information set forth herein is based on technical data that Descol believes to be reliable as of the data hereof. Since conditions of use are outside our control, we make no warranties, expressed or implied and assume no liability in connection with any use of this information Nothing herein is to be taken as a license to operate under or a recommendation to infringe any patents.

Appendix C

HWES Staff Survey Responses

Skin Irritation, Dryness, Redness or Rash

Response	Number	Percent
Yes	5	71%
No	2	29%
Total	7	100%

Dry, Itching, Burning, Watering or Irritated Eyes

Response	Number	Percent
Yes	3	43%
No	4	57%
Total	7	100%

Stuffy or Runny Nose or Sinus Congestion not related to an Infection

Response	Number	Percent
Yes	6	86%
No	1	14%
Total	7	100%

Shortness of Breath

Response	Number	Percent
Yes	1	14%
No	6	86%
Total	7	100%

Sore, Hoarse or Dry Throat

Response	Number	Percent
Yes	6	86%
No	1	14%
Total	7	100%

Tingling in Hands and Feet

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Headaches

Response	Number	Percent
Yes	5	71%
No	2	29%
Total	7	100%

Dizziness, Lightheadedness, or Loss of Balance

Response	Number	Percent
Yes	1	14%
No	6	86%
Total	7	100%

Nausea or Upset Stomach

Response	Number	Percent
Yes	1	14%
No	6	86%
Total	7	100%

Pain or Stiffness in the Back, Shoulders or Neck

Response	Number	Percent
Yes	5	71%
No	2	29%
Total	7	100%

Difficulty Remembering Things or Concentrating

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Ear Problems such as Pain, Ringing or Difficulty Hearing not related to an Infection

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Wheezing in your Chest

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Tightness across the Chest

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Coughing

Response	Number	Percent
Yes	4	57%
No	3	43%
Total	7	100%

Sneezing

Response	Number	Percent
Yes	2	29%
No	5	71%
Total	7	100%

Unusual Tiredness, Fatigue or Drowsiness

Response	Number	Percent
Yes	3	43%
No	4	57%
Total	7	100%

Appendix D

Risk Factor Information for Breast Cancer

How to Use this Factsheet

This risk factor summary was developed to serve as a general fact sheet. It is an overview and should not be considered exhaustive. For more information on other possible risk factors and health effects being researched, please see the References section.

A risk factor is anything that increases a person's chance of developing cancer. Some risk factors can be controlled while others cannot. Risk factors can include *hereditary conditions*, *medical conditions or treatments*, *infections*, *lifestyle factors*, or *environmental exposures*. Although risk factors can influence the development of cancer, most do not directly cause cancer. An individual's risk for developing cancer may change over time due to many factors and it is likely that multiple risk factors influence the development of most cancers. Knowing the risk factors that apply to specific concerns and discussing them with your health care provider can help to make more informed lifestyle and health-care decisions.

For cancer types with environmentally-related risk factors, an important factor in evaluating cancer risk is the route of exposure. This is particularly relevant when considering exposures to chemicals in the environment. For example, a particular chemical may have the potential to cause cancer if an individual inhales the chemical but that same chemical may not increase the risk of cancer if an individual has skin contact with the chemical. In addition, the dose and duration of time one might be exposed to an environmental agent is important in considering whether an adverse health effect might be expected.

Gene-environment interactions are another important area of cancer research. An individual's risk of developing cancer may depend on a complex interaction between their genetic make-up and exposure to an environmental agent (for example, a virus or a chemical contaminant). This may explain why some individuals have a fairly low risk of developing cancer as a result of an environmental factor or exposure, while others may be more vulnerable.

Key Statistics

Breast cancer is the most frequently diagnosed cancer among women in the United States, except for skin cancers. The American Cancer Society estimates that in 2010, approximately 207,090 women in the U.S. and 5,320 women in Massachusetts will be diagnosed with breast cancer and the disease will account for approximately 28% of all cancer diagnoses in females. Between 2003 and 2007, breast cancer accounted for 28% of cancer diagnoses in females in Massachusetts.

After increasing from 1994 to 1999, the incidence of breast cancer in females in the United States decreased from 1999 to 2006 by 2.0% per year. In Massachusetts, the incidence of invasive breast cancer in females remained stable during the period 2003-2007.

The chance of developing invasive breast cancer at some time in a woman's life is about 1 in 8. Women are 100 times more likely than men to develop this disease and risk increases with age. Men can also develop breast cancer, but male breast cancer is rare, accounting for less than 1% of all breast cancer cases. For more information on breast cancer in men, visit the American Cancer Society website at www.cancer.org.

A woman's risk of developing breast cancer increases with age. About 12-13% invasive breast cancers are found in women younger than 45, while about 66% are found in women age 55 or older. White women are slightly more likely to develop breast cancer than women of other races and ethnicities.

Types of Breast Cancer

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Cancers are classified by the location in the body where the disease originated (the primary site) and the tissue or cell type of the cancer (histology).

There are several types of breast cancer, although some of them are quite rare. In some cases a single breast tumor can have a combination of these types or have a mixture of invasive and *in situ* cancer.

In situ breast cancers are considered the earliest stage of cancer, when it is confined to the layer of cells where it began. They have not invaded into deeper tissues in the breast or spread to other organs in the body, and are sometimes referred to as non-invasive breast cancers. The remainder of this risk factor summary pertains to invasive breast cancers. Additional information on *in situ* breast cancers and other benign breast conditions can be found at www.cancer.org (American Cancer Society).

An invasive, or infiltrating, cancer is one that has already grown beyond the layer of cells where it started (as opposed to carcinoma *in situ*). Most breast cancers are invasive carcinomas -- either invasive ductal carcinoma or invasive lobular carcinoma.

Invasive ductal carcinoma (IDC) is the most common type of breast cancer and accounts for 75%–80% of all breast cancers. IDCs begin in the cells lining the milk duct of the breast, break through the wall of the duct, and grow into the fatty tissue of the breast. Once this occurs, IDCs may spread (metastasize) to other parts of the body through the lymphatic system and bloodstream.

Invasive lobular carcinoma (ILC) starts in the milk-producing glands (lobules) and account for approximately 10% of invasive breast cancers. Like IDC, it can metastasize to other parts of the body. Invasive lobular carcinoma may be harder to detect by a mammogram than invasive ductal carcinoma.

Other less common types of invasive breast cancer include:

- inflammatory breast cancer
- triple-negative breast cancer
- medullary carcinoma
- metaplastic carcinoma
- mucinous carcinoma
- Paget's disease
- tubular carcinoma
- papillary carcinoma
- adenoid cystic carcinoma or adenocystic carcinoma
- Phyllodes tumor
- angiosarco

Established Risk Factors

Hereditary Conditions

Having a family history of breast cancer increases a woman's risk of developing the disease. Women who have a first-degree relative (e.g. mother, sister) with breast cancer have about twice the risk of developing breast cancer themselves. Having two first-degree relatives with this disease increases a woman's risk by five-fold. Overall, about 20-30% of woman with breast cancer have a family member with the same disease. Therefore, 70-80% of women who have breast cancer have no familial link to the disease.

About 5-10% of breast cancer diagnoses are thought to be due to an inherited genetic mutation. Most of these mutations occur in the *BRCA1* and *BRCA2* genes. Other genes that may lead to an increased risk for developing breast cancer include *ATM*, *CHEK2*, *p53* and *PTEN*. Women who inherit these gene mutations have up to an 80% chance of developing breast cancer during their lifetime.

Medical Conditions and Treatments

Certain benign breast conditions may increase one's risk for breast cancer. Women with proliferative lesions without atypia (i.e., abnormal or unusual cells), which have excessive growth of cells in the ducts or lobules of breast tissue have a slight increased risk of developing breast cancer. Proliferative lesions with atypia, when the cells are excessively growing and no longer appear normal, raise one's risk by 4 to 5 times. Women with denser breast tissue (as seen on a mammogram) have more glandular tissue and less fatty tissue, and have a higher risk of breast cancer.

A woman with cancer in one breast is 3 to 4 times more likely to develop a new cancer in the other breast or in another part of the same breast. In addition, a previous diagnosis of an *in situ* breast cancer puts a woman at increased risk for an invasive breast cancer.

Cumulative exposure of the breast tissue to estrogen is associated with breast cancer risk. Several factors can influence estrogen levels. Women who started menstruating at an early age (before age 12) and/or went through menopause at a later age (after age 55) have a slightly higher risk of breast cancer. Also, women who have had no children or those whose first pregnancy occurred when they were over the age of 30 have an increased risk for developing breast cancer. Women who have had more children and those who have breast-fed seem to be at lower risk.

Use of hormone replacement therapy is another factor that may affect breast cancer risk. Long-term use (several years or more) of combined post-menopausal hormone therapy (PHT) increases the risk of breast cancer. The increased risk from combined PHT appears to apply only to current and recent users. A woman's breast cancer risk seems to return to that of the general population within 5 years of stopping combined PHT. The use of estrogen-only replacement therapy (ERT) does not appear to increase the risk of breast cancer significantly but when used long term (for more than 10 years), ERT has been found to increase the risk of both ovarian and breast cancer in some studies.

Women who had radiation therapy to the chest area as treatment for another cancer are at significantly increased risk for breast cancer. This risk appears to be highest if the radiation is given during adolescence or puberty, when the individual’s breasts are developing.

From the 1940s through the 1960s some pregnant women were given the drug diethylstilbestrol (DES) because it was thought to lower their chances of miscarriage. These women have a slightly increased risk of developing breast cancer. A woman whose mother took DES while pregnant may also have a slightly higher risk of breast cancer.

Lifestyle Factors

Alcohol consumption has also been associated with increased risk for breast cancer. Compared with non-drinkers, women who consume one alcoholic drink a day have a very small increase in risk whereas those who have 2 to 5 drinks daily have about 1½ times the risk of women who drink no alcohol.

Possible Risk Factors

Environmental Exposures

A great deal of research has been reported and more is being done to understand possible environmental influences on breast cancer risk. Of special interest are compounds in the environment that have been found in animal studies to have estrogen-like properties, which could in theory affect breast cancer risk. For example, substances found in some plastics, certain cosmetics and personal care products, pesticides (such as DDE), and PCBs (polychlorinated biphenyls) seem to have such properties. To date, however, there is not a clear link between breast cancer risk and exposure to these substances.

Lifestyle Factors

Recent studies have indicated that being overweight or obese may put a woman at increased risk of breast cancer, especially after menopause. Similarly, women who are physically inactive throughout life may have an increased risk of breast cancer. Being active may help reduce risk by preventing weight gain and obesity.

Studies have found that women using oral contraceptives (birth control pills) have a slightly greater risk of breast cancer than women who have never used them, but this risk seems to decline once their use is stopped. Women who stopped using oral contraceptives for more than 10 years do not appear to have any increased breast cancer risk. When thinking about using oral contraceptives, women should discuss their other risk factors for breast cancer with their physician.

Lifetime risk of breast cancer is increased in women of higher socioeconomic status (SES) (e.g. income, education, etc.). Research suggests that this may be due to reproductive and lifestyle factors (age at first full-term birth, physical activity, diet, cultural practices, etc.).

Other Risk Factors That Have Been Investigated

Lifestyle Factors

Though links have been suggested, antiperspirants, bras, and breast implants have all been investigated as possible risk factors for breast cancer but no associations have been found.

The role of cigarette smoking in the development of breast cancer is unclear. Overall, data do not provide strong evidence for an association between active cigarette smoking and breast cancer risk. Some studies suggest a relationship between passive smoking and increased risk for breast cancer; however, confirming this relationship has been difficult due to the lack of consistent results from studies investigating first-hand smoke exposure.

Dietary fat intake is another factor that has been suggested to increase a woman's risk for breast cancer. Though studies have found decreased breast cancer rates in countries with a diet typically lower in fat, studies in the U.S. have not shown an association between the amount of fat in the diet and increased risk of breast cancer.

References/For More Information

Appendix D

Risk Factor Information for Breast Cancer

Much of the information contained in this summary has been taken directly from the following sources. This material is provided for informational purposes only and should not be considered as medical advice. Persons with questions regarding a specific medical problem or condition should consult their physician.

American Cancer Society (ACS). http://www.cancer.org

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- ACS. 2010. Inflammatory Breast Cancer.
- ACS. 2010. Detailed Guide: Breast Cancer in Men.

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- ASCO. 2010. Guide to Breast Cancer.
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Colditz GA, Baer HJ and Tamimi RM. 2006. Breast Cancer, Chapter 51 in Cancer Epidemiology and Prevention. 3rd ed. Schottenfeld D and Fraumeni JF Jr.,eds. Oxford University Press. pp: 995-1012.

Massachusetts Cancer Registry (MCR), Massachusetts Department of Public Health.

- MCR. 2010. Cancer Incidence and Mortality in Massachusetts 2003-2007: Statewide Report. Available at: http://www.mass.gov/Eeohhs2/docs/dph/cancer/registry_statewide_03_07_report.pdf

National Cancer Institute (NCI). http://www.cancer.gov

- NCI. 2009. What You Need to Know About Breast Cancer.

Appendix E

MDPH Sodium Fact Sheet

Sodium in Drinking Water Fact Sheet

Is sodium found in drinking water?

Yes, sodium is a naturally occurring element found in water and soil. Drinking water contributes only a small fraction (less than 10%) to the overall daily sodium intake which ranges from 115 to 750 milligrams per day (mg/d) for infants, 325 to 2700mg/d for children and 1100 to 3300 mg/d for adults.

The Massachusetts Department of Environmental Protection (MDEP) currently requires all water suppliers to notify the Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH), MDEP, and local Boards of Health of the detected concentrations of sodium in drinking water. Notification is required so that individuals who are on a sodium restricted diet or wish to monitor their sodium intake for other reasons will have this information.

What is sodium's purpose?

Sodium is an essential mineral which is necessary for the normal functioning of the body and maintenance of body fluids. Nerve function and muscle contraction are also affected by sodium intake.

Where do we get sodium?

Sodium cannot be stored or manufactured in the body and must be consumed in some drinking water and in foods such as animal foods, low-fat dairy products, some canned foods, pickles, and olives.

What is the current guideline for sodium in drinking water and who should be concerned about this guideline?

The MDEP guideline of 20 milligrams of sodium per liter of water represents a level of sodium in water that physicians and sodium-sensitive individuals should be aware of in cases where sodium exposures are carefully controlled. People who have difficulty regulating fluid volume as a result of several diseases such as hypertension and kidney failure are particularly affected by elevated levels of sodium.

Hypertension is the medical name for high blood pressure and is a common chronic medical problem in the United States. It is responsible for a major portion of cardiovascular disease and stroke deaths.

Kidney failure occurs when an excess of sodium in the body causes fluid concentrations to change and the kidney fails to remove fluid. The result is a kidney shut-down and the build-up of fluid in the body which can lead to edema and hypertension.

Appendix E

MDPH Sodium Fact Sheet

Edema is the collection of water in and around the body tissues. Mild cases of edema affect women prior to the start of their menstrual periods, and many pregnant women suffer with this condition.

How is sodium measured in my body?

Your doctor or health professional measures sodium by taking your blood or checking a urine sample (or both). If your sodium levels are elevated, your physician may prescribe a diet low in sodium.

Reducing sodium intake not only prevents high blood pressure, but may also prevent heart disease, according to clinical trial data from the National Heart, Lung, and Blood Institute of the National Institutes of Health.

Where do I go for more information?

If you have any questions about sodium and your health, call your physician or health professional.

If you have any questions regarding sodium in drinking water, call the Massachusetts Department of Environmental Protection's Drinking Water Program at (617) 292-5770.

References

Clayman, Charles B., Family Medical Guide. The American Medical Association. Random House. New York. 1994.

Gershoff, S. The Tufts University Guide to Total Nutrition. Harper Perennial Publishers.

Mabee, Marcia S., MPH, PhD. The CSTE Washington Report.

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This fact sheet was prepared by the Environmental Health Education and Outreach Program in the Bureau of Environmental Health, Massachusetts Department of Public Health.