Spaul Environmental, Inc.

A professional team of engineers, industrial hygienists, safety experts, physicians, and health scientists

Environmental and Medical Monitoring
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Hazard Communication

17 February 1994

Ms. Judith Hunt, Director
Risk Management and Safety Department
School Board of Broward County
1320 Southwest Fourth Street
Ft. Lauderdale, FL 33312

RE: McNab Elementary School IAQ Evaluation in 700-wing Classrooms

Dear Ms. Hunt:

On 4 February 1994, Dr. Wil A. Spaul (PhD, MPH, MSCE), who is a Certified Industrial Hygienist and Adjunct Associate Professor of Indoor Air Quality (College of Public Health, University of South florida - Tampa), conducted a preliminary indoor air quality (IAQ) evaluation in the 700-wing classrooms. This evaluation was conducted in response to concerns that had been expressed about Room 703 (school number 13).

The concerns that had been expressed about Room 703 involved strong musty odors, headaches, nausea, dizziness, and elevated temperatures. The room was also reportedly damp.

Although chiller problems had been previously identified and major chiller work is scheduled to occur very soon, other problems besides the chiller problem are the source of several of these problems.

The 700-wing has four classrooms that are in a row. Rooms 704, 705, and 706 are supplied by a roof-mounted air handler. Originally, room 703 was on the same system, but reportedly had been isolated from the roof-mounted unit. A unit ventilator was installed in this room (703) to provide air conditioning service.

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Room 703:

The inspection inside the unit ventilator revealed that the coils were dirty, the squirrel cage fans had a lot of paper debris in them, and the condensation pan was very dirty. The outdoor make-up air intake is almost plugged with old paint. There is a wall leak along the corridor side of the room and the carpet has been repeatedly wetted. The school has had the repair crews in repeatedly to repair this leak. Since the windows and doors were open during this evaluation, carbon dioxide concentrations were not determined.

Rooms 704, 705, and 706:

There was a pronounced musty odor in these rooms, which are all supplied by the same air handler. Carbon dioxide measurements were not determined because the doors were open. In Room 704, the carbon dioxide concentration was 865 ppm with 24 students present that had just returned to the room. Since the classrooms on this air handler had the doors and windows open, which would provide outdoor air, very little validity should be given to this measured concentration as being representative of proper air handler operating conditions.

700-wing Roof-mounted Air Handler:

The outdoor air intake controller is rusted in a fixed position, and the linkages between the controller unit and the dampers are broken. The outside air intake dampers are rusted in the closed position. The insulation inside the fan chamber had been recently replaced with Armorflex insulation, which was free of mold growths. Although the coils had apparently been recently cleaned (within the last year), mold growths were present on the front side of the coils. The low efficiency filters, fan and condensation pan were clean and free of visible mold growths.

600-wing Roof-mounted Air Handler:

In response to the concerns about Room 703, it was reported that only the 700-wing roof-mounted air handler had been cleaned. In order to appraise the conditions in the other roof-mounted air handler units, the 600-wing air handler unit was randomly selected for inspection.

The problems that were reported in the 700-wing unit with the outside air intake controller, linkages, and dampers were also observed in the 600-wing unit. The coils were very dirty and had

extensive mold growths through the coils. Considering the age of this unit, the insulation in the fan chamber was in very good shape and was free of visible mold growths. Mold growths were present in the condensation pan.

Renovated Wings:

Several wings (600, 800, and 900) had undergone a recent asbestos abatement and were in the final stages of renovation. Strong construction-related odors (carpeting, paint, glues) were present in these wings. With the outside air intake dampers in the closed position for the air handler units, these strong chemical odors are likely to remain and may become a source of indoor air quality complaints. It is recommended that the outside air intake dampers on these air handlers be fully opened to assist in purging these odors out of these rooms. Additionally, during the day, the doors and windows should be opened to further assist in ventilating these rooms. Since we are currently in the cooler and drier times of the year, opening the doors and windows should not present a moisture problem but will be very useful in purging these chemical odors.

SUMMARY:

The reported pattern of "Tight Building" and allergen-related complaints are very likely the result of inadequate outdoor air flows into these rooms and the mold growths in the air handler units - both the room unit ventilators and the roof-mounted air handlers.

RECOMMENDATIONS:

1. The outside air flow into all of these classrooms needs to be increased up to at least 15 CFM/person. At the present time, it is highly unlikely that many of these rooms are even getting the originally designed air flow of 5 CFM/person. The make-up air flow should comply with ASHRAE STD 62-1989 for an office and classroom; i.e., 20 and 15 CFM of outdoor air per person continuously

supplied, respectively. It is recommended that the outdoor air flows to each air handler be measured to ensure that this minimum flow of outdoor air is continuously supplied. It will be necessary for the air handlers that supply these areas to be measured at least at two of the following: the return air flow; the total air handler output; the outdoor make-up air flow. The purpose of measuring at least two of the above flows is to determine the percentage of supply air that is outdoor air. It is important that this percentage be calculated from actual flow or temperature dilution measurements. This percentage is then multiplied by the minimum flow at the register of concern to obtain the CFM of outdoor air flow for that site. If your test and balance firm conducts these measurements, have them provide a copy of all raw data and field measurements and a written description of their procedures. It is also recommended that a timed or interconnected air damper be installed on the make-up air vents to the large air handler rooms, so that these outdoor air ducts are closed when the zones that are supplied by those air handlers are not occupied, or when the air handler is not operating. The portables are included in these recommended air flow guidelines. If 15 or 20 CFM per person of outdoor air flow for the classrooms or office areas, respectively, are not possible, contact a Florida Licensed Mechanical Engineer to provide an evaluation on alternative methods to get an adequate outdoor air flow. (Facilities Department)

2. The room unit ventilators and roof-mounted units need to be thoroughly cleaned, which will be addressed in greater detail in the remaining portion of these recommendations. (Maintenance Department)

3. The roof-mounted supply air ducts should be inspected for possible leaks. In many of the duct junctions, the supply duct has been depressed and has pooled water. Any leaks into these supply ducts could serve as a growth site for microbial organisms, which can result in odors, allergy effects, and upper respiratory infections. (Maintenance Department)

4. Areas where carpets become wet should be promptly extracted and dried. Unhealthy bacterial growths can occur in wetted carpets in as little as 24 hours. Fans can assist this drying after the extraction with the carpet cleaner. (School)

5. Upgrade the return air filters to at least a medium removal efficiency filter. At present, most units had low removal efficiency filters, which were very dirty. (School)

6. The chilled water system should be operated at less than 45°F at the coils for the air handlers to ensure that proper dehumidification is being provided by the air handlers. At a 49-50°F temperature, cold damp air will be provided that will contribute to future surface mold growths. (School)

7. In order to achieve a successful resolution of an indoor air quality problem, there are two major aspects that must be addressed. These two aspects are the "engineering solution" for the cause of the problems, and the "people aspect". Often the engineering aspect is much easier to solve than the "people aspect" of the solution. The "people aspect" involves a deconditioning of beliefs that there are problems in the building, and is usually accomplished by keeping the employees informed about the problems, the engineering solutions to be utilized, and the time frames for anticipated resolution of the problem. It is recommended that the "people aspect" of this solution start promptly, and involve a series of meetings with employees and parents who have expressed a concern. It will be important to point out that the "building is not sick", just that some routine maintenance activities and design changes need to be completed. Dr. Spaul can be available during this meeting to assist you in this effort. (School)

8. The coils and inside of the air handler units should be thoroughly cleaned at least once a year, and more often if needed. This includes the portables. The coils should be inspected from both sides of the coils for evidence of discoloration (darker color) or accumulated debris. During the heating phases, this color change will not be as obvious as during the cooling phases, during which time condensation water will be on the coils. A thorough coil cleaning with a non-acidic, foaming coil cleaner (e.g., Trane Alkaline Foam Coil Cleaner or equivalent should be used) should be performed, followed by a pressure rinse from the filter side through the coil to the condensation pan. The cleaning process should continue until the foam remains clean and white. A self-rinsing coil solution is acceptable only as a periodic maintenance chemical, but should not be used exclusive of the annual foaming coil cleaner. Be sure to

thoroughly rinse the coils and condensation pan at the end of the coil cleaning process and then put the air handler into operation for several hours to flush out any odors before the return of the building occupants. (Maintenance)

9. The insulation, where there are small amounts of mold and debris that are visible, should be HEPA vacuumed, and then treated with Oxine. Oxine is an EPA approved disinfectant for air handlers. After HEPA vacuuming and disinfecting the insulation, the insulation should be coated with Portercept (Porter Paints) latex coating to inhibit future growth. This material has been recently approved by the EPA for use inside air handlers. The Oxine treatment may require several applications for some areas. Be sure to allow the Oxine to dry completely prior to applying the Portercept latex. A HEPA-filtered vacuum cleaner can be purchased through most safety supply or asbestos abatement supply stores. (Maintenance)

10. All air handler cleaning procedures should be performed at a time when the building occupants will be away from the building. Be sure to notify and remind the occupants prior to the cleaning and request that they keep away from the building during the times of the cleaning. All personnel who are involved in the cleaning should use appropriate personal protection during the cleaning and disinfecting process. Please refer to the manufacturer's MSDS for health and safety information about a particular chemical, and feel free to contact Dr. Spaul if you have any questions regarding the health and safety aspects of the cleaning procedures. (Maintenance)

11. After the decontamination of the air handlers has been completed, a detailed follow-up inspection should be conducted to ensure that these units have been properly decontaminated. (Risk Management and Safety Department)

12. In your contract with the mechanical contractor (if you choose to use an outside contractor), be sure to include, at a minimum, the following items. If you do the work in-house, you should also ensure that the following OSHA requirements are met. If you have any questions about any of these requirements, please call Dr. Spaul.

a) The contractor's employees shall wear at least a half-mask NIOSH-approved respirator that is equipped with a combination HEPA

filter and charcoal canister during the decontamination process. The contractor shall comply with the OSHA respirator regulations (29 CFR 1910.134).

b) The air handler shall be "locked out of service" during the decontamination, and the contractor shall provide the lock. The contractor shall comply with OSHA "lockout regulations" (29 CFR 1910.147).

c) The contractor shall ensure that his employees have been trained on the potential health effects of biological agents that can be found inside an air handler, and on the effects of the chemicals to be used inside the air handler. The contractor shall comply with the OSHA Hazard Communication program with respect to training his employees about the hazards to which his employees may be exposed (29 CFR 1910.1200).

d) A copy of the MSDS for each chemical to be used during the decontamination process shall be supplied to you at least 5 working days prior to use on School Board property.

e) The air handler units should be put into full and continuous operation for at least six hours prior to people re-entering the space that is supplied by the air handler. This will require that the work be performed between Friday night and Sunday afternoon, or over a holiday period. The outdoor air flow should be wide open during this building flushing period.

f) Any damage to the air handler or building that is caused by the contractor shall be repaired by the contractor at his expense.

13. The condensation pans should be frequently (monthly) inspected, and washed and flushed, if necessary. The condensation drain lines should be purged to ensure that the line drains freely. The use of biocidal strips in the condensation pan can be an effective way to minimize microbial growth in the condensation pan. Biocidal tablets are not recommended since they can be corrosive, and as they dissolve, they may plug the condensation drain line and result in an overflowed pan. Large (12-15") biocidal strips should be used instead of the small packages. Each of the larger air handler units

should have at least two of the large biocidal strips. (School)

14. The supply air ducts should have inspection/access panels installed, and these panels should be at least 24"x24", where possible. The HVAC worker should remove the panels to the air handlers to provide full access for inspecting and cleaning each unit. Some of these units will need access panels installed. Thoroughness in cleaning the units and sealing any frayed fiberglass areas is extremely important. (Maintenance)

15. Only a HEPA filtered vacuum cleaner is recommended for cleaning these air handlers, ducts and fiberglass insulation. Any other type of vacuum cleaner will allow the fiberglass fibers and microorganisms to be discharged into the exhaust air, and breathed by the service worker and building occupants. (Maintenance)

16. A licensed mechanical engineer should conduct an evaluation of the exhaust air flows to ensure that the building is being properly "flushed", yet at the same time keeping the building under a positive pressure relative to the outdoors. (Facilities Department)

17. Any areas where frayed, torn, or loose fiberglass insulation is observed should be either sealed or replaced. Even small amounts of fiberglass insulation can result in serious and ongoing health-related complaints - until the source is removed.

It has been a pleasure to have been able to assist you with this project. Please do not hesitate to contact me if you have any questions about this report.

Sincerely,

Wil A. Spaul tc

Wil A. Spaul, President
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Certified Industrial Hygienist

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