UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
ADMINISTRATION
AND RESOURCES
MANAGEMENT

MEMORANDUM

SUBJECT: Indoor Air Quality Decisions

FROM: Charles L. Grizzle
Assistant Administrator

TO: All Headquarters Employees

SUMMARY

The purpose of this memorandum is to communicate a number of decisions which have been made by the Office of Administration concerning the indoor air quality problem. These decisions are intended to ensure that the health and safety of EPA employees at the Waterside Mall complex and other Headquarters buildings are protected and that the process of upgrading and improving the physical environment can get back on track. These decisions also reflect the recognition that the renovation-related complaints are only one aspect of developing an effective indoor air quality management program for EPA Headquarters.

The key decisions are:

- Not to use any additional yardage of the carpeting now in stock and to take steps to ensure that floor covering materials used in future renovations do not contain 4-phenylcyclohexene (4-PC) or any other compound that could lead to pollutant levels that are known to pose health problems.

- To leave the carpeting which has already been laid undisturbed since levels of 4-PC have decreased to approximately 1 part per billion (ppb) or below and to avoid increasing the levels of 4-PC and other pollutants (e.g., dust) in the air in the removal process.

- To expend the resources necessary to conduct a comprehensive state-of-the-art indoor air quality health survey of Waterside Mall occupants and to explore the cost and methodology of conducting a full scale epidemiology study. Other steps are also being taken to provide assistance to employees who have actually experienced health effects.

- To conduct an in-depth assessment of the adequacy of ventilation in each EPA-occupied space in the Waterside Mall complex and to identify necessary enhancements.

- To budget for and continue on a permanent basis the expanded operating hours of the ventilation system.

• To conduct a survey of other sources of indoor air pollution that may be present in the complex (including biological contaminants) and to identify source reduction strategies.

• To develop a long range plan for improving and maintaining indoor air quality at all EPA Headquarters sites.

• To hire an indoor air quality oriented architect to draft a major indoor air component to be incorporated into the technical facility requirements for the new EPA Headquarters building.

THE CARPETING DECISION

Since last October, when extensive renovations to office spaces in the Waterside Mall complex began, we began to see a significant increase in complaints of poor air quality, many of which were directly associated with the new carpeting being installed, and, to a lesser extent, with the partitions being installed. On April 29, 1988, I instituted a moratorium on the installation of all new carpeting.

Initial testing for 98 chemicals, many of which were volatile organic compounds (VOCs), was undertaken by the Environmental Response Team (ERT) from Edison, New Jersey. These compounds were identified for testing based on available information on compounds which are typically found in indoor air. This initial round of testing found approximately thirty compounds in the low parts per billion (ppb) range. These levels were below thresholds which have been found to pose significant risks to health.

Subsequent to this testing, the National Federation of Federal Employees (NFFE) brought to our attention work conducted by Dr. Mark Van Ert of the University of Arizona which identified a previously unknown compound, 4-phenylcyclohexene (or 4-PC for short), as an unintentional by-product of the reaction of 1,3, butadiene and styrene used in latex-backed carpeting. This study had been submitted to the Office of Toxic Substances (OTS) by Dr. Van Ert under the OTS Chemical Screening Program. A second and third round of chemical testing was conducted by ERT and by the Office of Research and Development (ORD), this time with 4-PC identified as a target compound, among others. Levels of 4-PC were found in several renovated spaces. The highest reading measured was 5 ppb. At the same time, we asked ORD to conduct emission chamber tests on both the carpeting and the wall partitions to identify the content and rate of off-gassing from these materials. Although we are awaiting their final report, we have some preliminary results. No 4-PC, or significant levels of formaldehyde or other pollutants, was found to be off-gassing from the partitions. The study also indicates that the emission rate of 4-PC decreases over time. ORD modeling results indicate, assuming an air exchange rate of one air change per hour (ACH), room concentrations of 4-PC would be at or below about 1 ppb after approximately 60 days. These results are in general agreement with both the monitoring data we have received as well as Dr. Van Ert's study.

Initial studies have shown that 4-PC is a very strong odorant with an odor threshold that may be below 1 ppb. All indications -- including our own personal observations -- are that the odor of 4-PC is detectable at low ppb levels. This compound is probably, and I stress *probably*, responsible for many of the irritating effects experienced by employees in or near

renovated spaces. Unfortunately, no other health data exists on 4-PC other than Dr. Van Ert's preliminary work.

Faced with the need to break the current logjam of uncompleted moves and renovations, we formulated three options for consideration:

OPTION 1: Completely remove all carpeting that has been installed since October 1987 and replace it with an alternative flooring that we would test prior to purchase for the presence of potentially hazardous chemicals. Use the alternative flooring for all new renovations.

OPTION 2: Allow already installed carpeting to remain in completed EPA office spaces. Air out and use for new renovations the remaining inventory of this carpeting after testing to ensure that levels below 1 ppb have been achieved.

OPTION 3: Allow already installed carpeting to remain in completed EPA office spaces. Install in new renovations an alternative floor covering, tested before purchasing for the presence of potentially hazardous chemicals.

The option selected, with the concurrence of the Administrator and representatives of the Office of Air and Radiation, the Office of Research and Development, and the Office of Toxic Substances, is Option 3.

In evaluating these options we considered several factors. The potential health risks to EPA employees was our primary consideration. Costs and Timing were secondary considerations.

1. Health Risks

The potential health risks we identified for consideration under each option were: exposure to 4-phenylcyclohexene (4-PC), exposure to volatile organic chemicals (VOCs), and exposure to dust.

• **4-phenylcyclohexene (4-PC):** Our major concern continues to be the effects of exposure to the compound 4-phenylcyclohexene (4-PC). Very little information is available on the health effects of 4-PC. There are reports of respiratory irritation from this chemical in people exposed to newly installed carpeting, but these reports are anecdotal. Preliminary tests in animals also suggest this chemical is an irritant. However, these tests were not performed using test protocols that EPA would accept for regulatory purposes.

Nonetheless, the limited information available suggests that 4-PC is a strong respiratory irritant. EPA's Office of Toxic Substances is actively pursuing data on the health effects of 4-PC.

An even more troubling aspect of the issue is the varying sensitivity of individuals to this and other pollutants present in indoor environments. Several employees have experienced symptoms which indicate a continuing sensitivity to chemical compounds. Unfortunately, we

understand that the issue of chemical sensitivity is a new issue which has not been adequately studied or characterized by the scientific community. Whether or not such sensitivity was initiated by exposure to 4-PC, and many other aspects of the issue of chemical sensitivity, are likely to remain undocumented for some time.

Based on the air monitoring and chamber studies, we have found that the levels of 4-PC have dropped significantly since installation. While we do not have sampling data from freshly carpeted areas, we have been able to postulate from the existing data that levels in newly carpeted rooms were probably in excess of 10 ppb of 4-PC and could have been as high as 50 ppb. (A reading of 70 ppb was found in the immediate vicinity of the carpeting stored in the warehouse.) The levels of 4-PC in renovated rooms ranged from approximately 0.5 ppb to 1.5 ppb in May. One of the most recently renovated areas, SE-226, SE-227, and SE-273, initially had the highest level of 4-PC measured in the complex (>5 ppb) but when resampled at the end of June was below 1 ppb.

• **Volatile Organic Compounds (VOC):** The level of VOCs measured in the building were found to be typical of the levels found in indoor environments. However, some individuals may be sensitive to the short-term elevated levels of these chemicals that are produced during carpet installation. The option of tearing out and replacing the carpeting would result in the highest level of VOCs in the air, because more new flooring would have to be installed. Installation of alternative flooring only in new renovations will probably increase VOC levels somewhat. We will utilize installation procedures and scheduling that will minimize exposure to VOCs.

• **Dust:** Some individuals are sensitive or allergic to elevated levels of dust that accompany space renovations. Again, the option of tearing out and replacing existing carpeting would create a higher level of exposure than using alternative flooring only for new renovations.

• **Other Potential Hazards:** We found through the air monitoring at Waterside Mall that levels of semi-volatile organic compounds other than 4-PC, including formaldehyde, were below levels associated with known health effects.

2. Costs

Costs carried lower weight than health risks in our evaluation of options. The following is an estimate of costs for each option:

Option 1: Tear out and replace carpeting: $1.2 to $2.2 million (depending on the floor covering selected).

Option 2: Air out and use remaining inventory after testing: $125,000.

Option 3: Install alternative floor covering in newly renovated areas; test covering purchased: $125,000 to $525,000 (depending on floor covering selected).

A more difficult, but nevertheless significant, cost to estimate is the cost of disrupting the roughly 2000 employees who currently occupy space in which the carpeting has been laid. Removal of that carpeting would require relocating all of those individuals and their belongings to alternative space and back again; a process which would cost several hundred thousand dollars, not including productivity losses.

3. Timing

Timing carried the lowest weight in our analysis. Tearing out and replacing the carpet we recently installed would take the longest time, airing out and using carpeting in stock would take the least time, and using alternative flooring in new renovations would be somewhere in between.

The Decision

While no one can say with certainty that levels of 4-PC in the 1 ppb range are absolutely "safe", we must rely on the best collective judgement available to us, including Dr. Van Ert, and representatives of OTS, OAR, and ORD. We believe that the continued decrease of the 4-PC levels in the building, combined with the improvements we are making in the ventilation systems (described below) and the other factors we considered, make it unnecessary to remove already installed carpeting. We are therefore planning to move those employees currently waiting to occupy SE-226, SE-227, and SE-273 as soon as possible. All other carpeted areas are already occupied. The search for alternative floor covering materials will continue until we identify an appropriate substitute for the carpeting, at which time further renovation work will be scheduled. We will make a point of posting notifications for occupants of spaces slated for renovation of the anticipated time and expected duration of the work.

None of the existing carpeting will be laid at Waterside Mall. However, efforts to return the carpeting to the manufacturer have not been successful since it does not appear that we could legally force the company to take the carpeting back as defective. ERT and other Agencies have expressed interest in using the carpeting and we are going to explore this and other options that would allow the roughly $200,000 worth of carpeting to be used safely. I can assure you, however, that none of the carpeting will be used anywhere without full disclosure of all information available to potential users.

EMPLOYEE HEALTH

The major concern for all of us, labor and management alike, is to ensure that we are all able to work in an environment that is as safe as we can possibly make it. Approximately half a dozen EPA employees have been advised by their physicians not to reenter the building. Some of these employees have signs of having developed a chemical sensitivity. A significantly larger number of employees have complained of symptoms which most associate with the renovation work. Other employees have expressed concerns that pre-date the current episode and which raise the issue of chronic or long term problems. We are taking all of these concerns seriously and are attempting to respond supportively.

We have provided assistance to the individuals who have filed Workers' Compensation claims and we understand that one such claim was recently granted by the Department of Labor (DOL). The Administrator will thank DOL for their timely response and request swift action on the claims filed by other employees. We will continue to try to improve the assistance we can provide to employees who are in the unfortunate position of being unable to enter the building without experiencing health effects.

As most of you are aware, we have retained the services of an occupational medicine specialist to provide free medical consultations, including lab tests, for employees who are experiencing problems which they believe to be related to the building environment. Strict doctor/patient confidentiality will be observed. I encourage you to avail yourself of this service. Also, I strongly encourage you to contact your supervisor or my office if you continue to experience problems in your work environment.

A number of employees and union representatives have requested that a health survey be conducted of EPA employees and that a full scale epidemiology study be conducted to study potential patterns of illness or unusual symptoms over time. While we had intended to conduct a non-scientific survey quickly, we have discovered that a scientifically designed survey instrument has been developed in a joint effort by the J.B. Pierce Foundation associated with Yale University, the National Institutes of Occupational Safety and Health (NIOSH), and EPA's Office of Research and Development. While this survey was originally designed to be used as a pilot in a study of the Library of Congress building, Dr. Brian Leaderer of Yale has agreed to modify the survey instrument for use at EPA. The questionnaire is a census type (rather than a statistical) survey and is designed to ensure strict respondent confidentiality. Although the survey instrument was designed to obtain a "snapshot" of the health of employees at a particular point in time, we have asked Dr. Leaderer to incorporate sufficient questions to allow us to screen for longer term effects. Since the survey must be conducted during peak heating or cooling seasons (to get "worst case" conditions) and to allow time for needed modifications, we hope to conduct the survey in January or February of 1989, assuming that we are able to obtain clearance from OMB.

With respect to the full-scale epidemiology study, we are asking ORD to help us scope out conceptually what hypotheses such a study could test for and what would be required in terms of resources. We are hoping to be able to obtain sufficient information through the health survey to help us determine how best to proceed.

VENTILATION

As you are no doubt aware, the ability of the ventilation system for the Waterside Mall complex to both supply an adequate amount of fresh air and to dilute and remove pollutants that build up in indoor spaces is of paramount importance to indoor air quality.

We are taking a number of steps to substantially improve the quality and efficiency of the ventilation systems at the WSM complex. First, in an effort to improve the air quality on Monday mornings, when many people complained of stuffy and uncomfortable thermal

conditions, we negotiated with Town Center Management (which is responsible for and controls the ventilation system) for extended hours of operation of the air handling system to increase the intake of outside air and to condition that air. While the extended hours are costly, we have decided to make the new hours permanent since it appears to be having a positive effect.

Second, we conducted an in-depth analysis of 6 of the 32 air handling units in the complex to assess their operating parameters and determine the amount of outside vs. recirculated air entering the building. The ventilation engineer also looked at several individual rooms to try to assess the effectiveness of the distribution of air in these spaces. The evaluation determined that the air handling units are generally meeting the lease requirements of 10% outside air. However, there are a number of problems related to the air handling equipment (e.g., higher than normal chiller temperatures, poorly designed supply air diffusers) as well as our high per-office occupancy rates and increased thermal loading from the computer equipment which adversely impact the ability of the ventilation system to provide adequately conditioned air to all spaces all of the time. We are having the same engineering analyses performed on the remaining 26 air handlers in the complex to evaluate their effectiveness. These analyses should be completed this fall. In conjunction with this evaluation, we will calculate the outside air intake in cubic feet per minute (cfm) per occupant, a standard unit of measure for ventilation. This should tell us whether and where there are air handling units which are serving overcrowded spaces or where air distribution to individual spaces is not sufficient.

Third, we have already invested approximately $100,000 in hardware improvements to the ventilation system, and an additional $300,000 in improvements are planned. These include raising the stacks on exhaust pipes which are too close to air intakes, reconnecting duct work, modifying air diffusers, and installing additional air conditioners, dehumidifiers and other needed equipment. New and more effective air diffusers will be installed in all future spaces which undergo renovation.

We are working very closely with Town Center Management to make as many improvements as are feasible. Nevertheless, it is important to recognize that the system is complex and limited in its capabilities and that space utilization over the years has not been governed by indoor air quality concerns.

SOURCE IDENTIFICATION AND CONTROL

We recognize that although the carpeting is likely the primary cause of the health symptoms experienced by many employees since renovations commenced, there are many other potential sources of indoor air contamination that may be present in the building, including biological contaminants which have not yet been looked at. We are going to undertake an effort to identify potential pollutants and sources that are present in the building complex and to assess ways of reducing the exposure of our employees to pollutants in general. It is critical that our future procurement efforts learn from this experience and that indoor air quality is considered as we bring new potential sources into the building.

In addition, we are going to increase our efforts to carry out our on-going maintenance and future renovation work at times of minimum occupancy, to boost the ventilation in areas where work is being done, and to provide adequate notice to employees before renovation work gets under way.

INDOOR AIR QUALITY MANAGEMENT PLAN

As noted in one of the recent Indoor Air Quality Updates circulated to all employees, we are beginning to work on a management plan for how we are going to achieve the best indoor air quality possible in the Waterside Mall complex, as well as Fairchild and Crystal City. We will be developing this plan over the next weeks and months, and will be asking for participation and comment from the Agency's technical experts, unions and interested employees.

PROJECT 1992 -- EPA'S FUTURE HOME

As you know, the decision has been made to find a new home for EPA Headquarters when the current leases on the Waterside Mall complex expire in 1992. Known as "Project 1992", we are heavily involved in developing technical facility specifications for the General Services Administration (GSA) to use in obtaining bids from developers for construction of the new building. A key goal of Project 1992 is to ensure that we have a building that is a model for indoor air quality in modern office buildings.

Toward this end, we have retained as a consultant Hal Levin, an architect recommended by the Indoor Air Staff in OAR who is an expert on designing for indoor air quality. Mr. Levin will be developing the indoor air component of the technical facility document for submission to GSA.

CONCLUSION

In recent months, we have learned a great deal about indoor air quality which had not previously been integrated into building operation and management at EPA Headquarters. Among other things, we have learned that indoor air quality is an emerging technical and policy field for which there are no easy answers and no perfect worlds. Nevertheless, we are going to strive to integrate our responsibility to provide a safe environment for EPA employees with our efforts to upgrade both our existing and future spaces. We would like this process to be an open one, in which labor and management can work cooperatively to improve and maintain the quality of our indoor environment. We hope, with your cooperation and assistance, to move forward.