

# Indoor Air Quality Update <sup># 4348</sup>

A Guide to the Practical Control of Indoor Air Problems, from **Cutter Information Corp.**

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## IAQ and Work Environment Study: EPA Headquarters Building

Prepared by the United States Environmental Protection Agency

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## TECHNICAL TEAMS

This study of indoor air quality and work environment was conducted by three technical teams representing multiple organizations. It was jointly developed and carried out at EPA headquarters and the Library of Congress' Madison Building under the auspices of these teams working independently of both management and unions at both EPA and the Library of Congress.

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## EXECUTIVE SUMMARY

### 1. Background

In recent years, employees at the three headquarters buildings of the U.S. Environmental Protection Agency (EPA) have expressed their concerns about indoor air pollution and work environment discomforts. Because of the difficulties encountered in determining the exact causes of such concerns about building environments, EPA has undertaken a systematic study of the nature and spatial distribution of employee health symptoms and comfort concerns in an attempt to determine if associations exist between employee responses and specific workplace conditions.

This is the first of three reports that investigate the perceived and actual quality of indoor air at EPA headquarters. This report documents the design of the study and the results of the detailed survey of all EPA employees conducted in February 1989. Three work complexes were surveyed: Waterside Mall and the Fairchild Building in Washington, D.C. and Crystal Mall in Arlington, Virginia. This report presents only a descriptive summary of the survey data. Results of the environmental monitoring will be presented in Volume II; multivariate analyses of both sets of study results will be presented in Volume III.

The research effort at EPA was integrated with a parallel study at the Library of Congress Madison Building. Both the EPA and the Library of Congress surveys made use of common study designs and survey instruments, although separate reports have been prepared for each agency. While certain features of the study are specific to the particular buildings involved, the survey was designed to be applicable to any building suspected of environmental problems.

Information continues to be obtained by both labor and management on the health symptoms of EPA employees and the quality of indoor air at EPA headquarters. For example, both the National Federation of Federal Employees Local 2050 and the American Federation of Government Employees Local 3331 have accumulated information on the illnesses experienced by EPA employees. This information is provided in a supplement to this report entitled, "Additional Employee Adverse Health Effects Information."

## 2. Study Design

Because of the lack of prior information on employee health that could be used as benchmark data, and because of the spatial variability of ventilation, thermal factors, and other conditions that influence health and comfort, a comprehensive survey of all EPA employees at each of the three headquarters locations was required. A self-administered questionnaire was distributed to all employees in February 1989, asking for information about health symptoms and comfort concerns, along with data on background health and demographic characteristics. Among the topics covered in the questionnaire were:

- Location of workstation (to detect associations between the survey and monitoring data);
- Description of workstation, both current and changes over the last year;
- Amount of time spent at workstation;
- Health symptoms experienced while in building, both in the previous week and in the previous year;
- Other health characteristics and risk factors: wearing of contact lenses and eyeglasses, smoking, allergies, asthma, etc;
- Eye, nose, throat, or respiratory irritation from tobacco smoke or other chemicals during last year;
- Gynecological problems during last year;
- Comfort issues: temperature, humidity, air movement, noise, dust, light, odors, and furniture during last year;
- Job characteristics, including job satisfaction and job stress; and
- Education, job pay plan and grade, and job classification.

To increase participation in the survey, both management and unions were given the opportunity to review the draft questionnaire and their endorsements were communicated to all employees prior to the survey. Stringent measures were taken to ensure the confidentiality of all responses.

Findings from the employee survey were used to rank all rooms in the buildings on the basis of a health symptom index and comfort index, and then to select about 100 locations for

environmental monitoring and physical measurements. Environmental monitoring was conducted three weeks after the employee survey. All locations were monitored for temperature, relative humidity, carbon dioxide, and carbon monoxide. A subset of locations was also sampled for nicotine, biological contaminants, particles, formaldehyde and other aldehydes, other volatile organic compounds, and pesticides. In addition, ventilation parameters were measured.

While the monitoring was in process, a supplemental questionnaire was also administered to all employees near the environmental equipment. This provided a basis of comparison between air measurements and employee experiences on the same day.

### 3. Results of the Employee Survey

The overall response rate for the survey questionnaire across all three buildings was 81 percent, with 3,955 of an estimated 4,900 EPA employees completing the survey. More than 1,400 employees also took the opportunity to volunteer additional comments in the "essay" question provided at the end of the survey form.

Key results are reported below, first for health symptoms and then for comfort issues. It is important to note that the health symptoms and comfort issues reported in the survey are self-reported by the respondents, and have not been verified by a physician's diagnosis as part of this study. No attempt is made in this report to associate health or comfort outcomes with possible risk factors in the buildings. These analyses will be the focus of Volume III.

#### Health Symptoms by Building

The most frequently occurring health symptoms reported by respondents were roughly similar across the three buildings -- headaches, contact lens problems (among contact lens wearers), stuffy nose, dry/itchy skin, dry/itchy/tearing eyes, strained eyes, and sleepiness.

To focus the findings on health symptoms that are potentially building-related, the report uses the concept of "cases." Each case represents an employee who reported experiencing a health symptom "often" or "always" last year and whose health symptom reportedly got better when

the employee left work. The use of "cases" is intended to focus on symptoms that are recurring rather than occasional and that appear to be connected in some way to the building.

As Exhibit ES-1 shows, the highest percentages of cases were reported for the same top seven symptoms across all three buildings (although ranked in different orders in each building):

- headache
- stuffy nose/sinus congestion
- dry, itching, or tearing eyes
- sore/strained eyes
- unusual fatigue or tiredness
- sleepiness or drowsiness
- contact lens problems (among contact lens wearers)

Each of these symptoms was experienced often or always by at least 10 percent of respondents and was reported to improve after the employee left work. Another view of the same data is provided in Exhibit ES-2 which groups the symptoms into three categories:

1. Indoor Air Quality Symptoms, typically associated with acute discomfort, such as headache, runny nose, stuffy nose/sinus congestion, dry, itching, or tearing eyes, burning eyes, dry throat, fatigue, and sleepiness;
2. Respiratory or Flu-like Symptoms, which may be manifested in clinically defined illnesses that may require prolonged recovery times after leaving the building. Such symptoms include cough, wheezing, shortness of breath, chest tightness, fever, and aching muscles or joints; and
3. Ergonomic Symptoms, which include back pain or stiffness, and pain or numbness in the shoulder, neck, hands, or wrists.

As Exhibit ES-2 shows, the predominant symptoms reported in each building are those associated with poor indoor air quality. Headache, fatigue, and symptoms associated with mucous membrane irritation have often been reported in published evaluations of indoor air quality.

The use of "cases" may be considered by some as representing a conservative estimate of symptoms experienced by respondents. For example, it may be useful to consider the prevalence of symptoms reported by respondents sometimes, in addition to often or always. Therefore, for comparison, Exhibit ES-3 provides the percent of all respondents who had



**Exhibit ES-1: Percent of All Respondents Who Had Symptoms Often or Always Last Year that Got Better Upon Leaving Work, by EPA Headquarters Building**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Headache	16%	11%	16%
Nausea	1%	1%	1%
Runny nose	8%	9%	7%
Stuffy nose/sinus congestion	16%	17%	15%
Sneezing	7%	7%	8%
Cough	4%	5%	4%
Wheezing or whistling in chest	1%	1%	2%
Shortness of breath	2%	1%	2%
Chest tightness	2%	1%	2%
Dry, itching, or tearing eyes	17%	12%	15%
Sore/strained eyes	16%	12%	18%
Blurry/double vision	4%	3%	5%
Burning eyes	10%	8%	11%
Sore throat	4%	3%	4%
Hoarseness	3%	2%	1%
Dry throat	10%	7%	9%
Unusual fatigue or tiredness	15%	14%	11%
Sleepiness or drowsiness	15%	19%	13%
Chills	5%	1%	2%
Fever	1%	1%	0%
Aching muscles or joints	4%	4%	2%
Problems with contact lenses*	28%	19%	27%
Difficulty remembering things	2%	2%	2%
Dizziness/lightheadedness	3%	2%	1%
Feeling depressed	5%	5%	4%
Tension or nervousness	10%	11%	8%
Difficulty concentrating	7%	6%	5%
Dry or itchy skin	6%	4%	6%
Pain or stiffness in upper back	6%	6%	6%
Pain or stiffness in lower back	6%	6%	4%
Pain or numbness in shoulder/neck	6%	5%	5%
Pain or numbness in hands or wrists	2%	2%	2%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

**Exhibit ES-2: Percent of All Respondents Who Had Symptoms Often or Always Last Year that Got Better Upon Leaving Work, by EPA Headquarters Building and by Group of Symptoms**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<u>Indoor Air Quality Symptoms</u>			
Headache	16%	11%	16%
Runny nose	8%	9%	7%
Stuffy nose/sinus congestion	16%	17%	15%
Dry, itching, or tearing eyes	17%	12%	15%
Burning eyes	10%	8%	11%
Dry throat	10%	7%	9%
Unusual fatigue or tiredness	15%	14%	11%
Sleepiness or drowsiness	15%	19%	13%
<u>Respiratory or Flu-like Symptoms</u>			
Cough	4%	5%	4%
Wheezing or whistling in chest	1%	1%	2%
Shortness of breath	2%	1%	2%
Chest tightness	2%	1%	2%
Fever	1%	1%	0%
Aching muscles or joints	4%	4%	2%
<u>Ergonomic Symptoms</u>			
Pain or stiffness in upper back	6%	6%	6%
Pain or stiffness in lower back	6%	6%	4%
Pain or numbness in shoulder/neck	6%	5%	5%
Pain or numbness in hands or wrists	2%	2%	2%

Reference: Part II, Question 7.

**Exhibit ES-3: Percent of All Respondents Who Had Symptoms Sometimes, Often or Always Last Year and that Got Better Upon Leaving Work, by EPA Headquarters Building**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Headache	41%	30%	42%
Nausea	10%	7%	19%
Runny nose	20%	18%	15%
Stuffy nose/sinus congestion	29%	26%	29%
Sneezing	22%	20%	20%
Cough	14%	12%	12%
Wheezing or whistling in chest	4%	3%	2%
Shortness of breath	7%	5%	6%
Chest tightness	6%	12%	6%
Dry, itching, or tearing eyes	35%	29%	34%
Sore/strained eyes	37%	35%	40%
Blurry/double vision	12%	8%	14%
Burning eyes	27%	22%	27%
Sore throat	14%	12%	11%
Hoarseness	10%	6%	8%
Dry throat	23%	18%	23%
Unusual fatigue or tiredness	34%	32%	32%
Sleepiness or drowsiness	41%	42%	40%
Chills	16%	10%	11%
Fever	4%	3%	3%
Aching muscles or joints	10%	7%	9%
Problems with contact lenses*	47%	38%	46%
Difficulty remembering things	10%	8%	8%
Dizziness/lightheadedness	15%	17%	9%
Feeling depressed	19%	17%	15%
Tension or nervousness	32%	33%	28%
Difficulty concentrating	27%	27%	23%
Dry or itchy skin	12%	11%	11%
Pain or stiffness in upper back	16%	14%	18%
Pain or stiffness in lower back	16%	15%	19%
Pain or numbness in shoulder/neck	14%	12%	16%
Pain or numbness in hands or wrists	7%	6%	7%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

symptoms sometimes, often, or always and that got better upon leaving work. In addition, it is recognized that certain symptoms that may be building-related do not improve upon leaving work (e.g., muscle pains, hypersensitivity reactions, and immune responses). The main body of the report includes exhibits that eliminate the "got better upon leaving work" criterion.

About a third of respondents (28 to 38%) in each of the three buildings indicated that their symptoms reduced their ability to work at least some of the time. About a quarter of respondents indicated that their symptoms resulted in having to stay home or leave work early sometimes or often in the past year (22 to 25% at each building).

Among Waterside employees, 62 percent of respondents associated one or more of their symptoms with their work building, compared to 56 percent of Crystal respondents and 49 percent at Fairchild. Of those employees reporting that they "often" or "always" experienced symptoms, the percentage who reported that their symptoms improved when they left the building generally ranged between 60 and 70 percent.

More employees in Waterside than in the other buildings reported that both the frequency and duration of their infections had increased since they began work in their building. At Waterside, 39 percent of respondents reported more frequent infections (compared to 31 percent and 23 percent for Crystal and Fairchild, respectively), and 36 percent of Waterside respondents reported longer lasting infections since beginning work there (compared to 31% and 23% for Crystal and Fairchild, respectively).

Among nine listed possible sources of eye, nose, throat, and respiratory irritation, paint and tobacco smoke were among the top four irritants in all three buildings. At Waterside Mall, fumes from new carpeting, paint, and tobacco smoke were mentioned as the three leading sources of irritation. Crystal respondents were more likely to identify paint fumes, tobacco smoke, and fumes from copy machines. Fairchild respondents pointed primarily to new carpeting, tobacco smoke, and fumes from new drapes and paint. About one third of all respondents reported that they consider themselves especially sensitive to the irritants mentioned.

### **Health Symptoms in Waterside Mall Sectors**

A fairly clear pattern of health symptoms emerges when one breaks down the Waterside Mall complex into six separate "sectors." A greater prevalence of the problems reported in Waterside Mall are associated with the 2nd floor Mall, 3rd floor Mall, and Southeast Mall sectors. Respondents in these three sectors were also more likely to report that their symptoms reduced their ability to work and they perceived a stronger association of their symptoms with the building than respondents in other sectors.

Exhibit ES-4 shows data on cases reported for each of the six sectors of Waterside Mall. The same 7 symptoms noted above receive the most reports of cases. The 2nd and 3rd floors of the Mall and the Southeast Mall report the highest percentages of problems, with 20 percent or more respondents reporting cases of stuffy nose/sinus congestion (3rd floor Mall); dry, itching, or tearing eyes (2nd floor Mall and Southeast mall); sore/strained eyes (2nd floor Mall); and sleepiness or drowsiness (Southeast Mall). Among respondents who wear contact lenses at work, the percentage who reported problems with their lenses reached 45 percent in the 2nd floor Mall and 38 percent on the 3rd floor Mall.

### **Health Symptoms Reported Last Week**

Respondents were asked on how many days last week they experienced the individual symptoms while working in the building. This question was thought to provide a more immediate, and perhaps more accurate, measure of the extent of symptom occurrence since the recall period was much more recent. In addition, this question was used to select sampling locations. The results reported in Exhibit ES-5, show the percentage of respondents experiencing the symptom at least one day on the previous week; also shown are the number of days respondents experienced the symptom in the last week.

In general, the results appear consistent with the relative ranking of cases in the previous year (Exhibit ES-1) although the percentages reporting symptoms are much higher. This is not surprising, however, since the percentages of symptoms experienced during the past year represented only those who responded "often" or "always" and whose symptoms got better when they left work. Forty percent or more of respondents in each building reported experiencing

**Exhibit ES-4: Percent of All Respondents Who Had Symptoms Often or Always Last Year that Got Better Upon Leaving Work, by Sector in Waterside Mall**

SYMPTOM	WATERSIDE MALL SECTOR					
	EAST TOWER	WEST TOWER	MALL 2ND FLOOR	MALL 3RD FLOOR	NE MALL	SE MALL
Headache	14%	13%	18%	19%	16%	18%
Nausea	1%	1%	1%	2%	2%	14%
Runny nose	7%	9%	9%	10%	8%	8%
Stuffy nose/sinus congestion	15%	13%	16%	21%	16%	16%
Sneezing	6%	7%	7%	8%	7%	6%
Cough	4%	5%	6%	6%	4%	2%
Wheezing or whistling in chest	1%	1%	1%	2%	1%	2%
Shortness of breath	1%	2%	3%	3%	3%	2%
Chest tightness	1%	1%	3%	2%	2%	2%
Dry, itching, or tearing eyes	14%	15%	21%	18%	13%	20%
Sore/strained eyes	15%	14%	22%	18%	14%	19%
Blurry/double vision	4%	4%	7%	3%	3%	3%
Burning eyes	9%	10%	13%	11%	9%	10%
Sore throat	3%	3%	7%	5%	3%	9%
Hoarseness	3%	3%	5%	3%	2%	4%
Dry throat	8%	9%	15%	12%	8%	14%
Unusual fatigue or tiredness	12%	15%	17%	17%	12%	15%
Sleepiness or drowsiness	13%	14%	18%	17%	14%	20%
Chills	2%	5%	5%	5%	6%	4%
Fever	4%	0%	0%	1%	1%	5%
Aching muscles or joints	3%	4%	5%	5%	4%	6%
Problems with contact lenses*	24%	25%	45%	38%	31%	29%
Difficulty remembering things	2%	2%	3%	3%	3%	1%
Dizziness/lightheadedness	3%	2%	5%	4%	3%	4%
Feeling depressed	5%	5%	4%	5%	6%	5%
Tension or nervousness	9%	10%	12%	10%	9%	12%
Difficulty concentrating	6%	6%	10%	10%	6%	10%
Dry or itchy skin	6%	6%	8%	8%	6%	5%
Pain or stiffness in upper back	4%	8%	5%	7%	6%	4%
Pain or stiffness in lower back	4%	7%	4%	6%	7%	6%
Pain or numbness in shoulder/neck	4%	5%	6%	7%	6%	4%
Pain or numbness in hands or wrists	2%	2%	4%	2%	1%	2%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

**Exhibit ES-5: Percent of All Respondents Reporting One or More Days of Symptom and Average Symptom Days Last Week, by EPA Headquarters Building**

SYMPTOMS	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	% 1+ Days*	Avg. Days	% 1+ Days*	Avg. Days	% 1+ Days*	Avg. Days
Headache	53%	2.0	47%	2.0	49%	2.2
Nausea	13%	1.7	12%	1.7	13%	1.6
Runny Nose	42%	2.7	36%	2.8	36%	2.7
Stuffy Nose	51%	2.9	47%	3.0	51%	2.8
Sneezing	40%	2.3	38%	2.3	40%	2.4
Cough	31%	2.6	30%	2.5	30%	2.5
Wheezing	8%	2.5	7%	2.6	8%	3.0
Shortness of Breath	11%	2.4	10%	2.6	9%	2.4
Chest Tightness	9%	2.3	11%	2.4	9%	2.3
Dry, Itching, or Tearing Eyes	41%	2.6	35%	2.7	40%	2.6
Sore/Strained Eyes	41%	2.6	37%	2.5	44%	2.6
Blurry/Double Vision	16%	2.5	13%	2.6	17%	2.7
Burning Eyes	28%	2.5	23%	2.6	29%	2.5
Sore Throat	25%	2.2	22%	2.2	22%	2.1
Hoarseness	15%	2.3	13%	2.5	14%	2.1
Dry Throat	31%	2.6	25%	2.7	26%	2.6
Unusual Fatigue	44%	2.6	40%	2.7	43%	2.5
Sleepiness	50%	2.4	49%	2.6	48%	2.4
Chills	18%	2.4	9%	2.2	15%	2.2
Fever	8%	1.9	6%	2.6	8%	1.9
Aching Muscles	26%	2.5	26%	2.7	21%	2.4
Problems w/ Contact Lenses**	46%	2.8	39%	2.6	44%	2.3
Difficulty Remembering Things	21%	2.4	18%	2.2	19%	1.9
Dizziness/Lightheadedness	18%	2.0	13%	2.2	15%	1.8
Feeling Depressed	27%	2.2	26%	2.4	26%	2.3
Tension or Nervousness	37%	2.3	39%	2.6	35%	2.4
Difficulty Concentrating	33%	2.3	33%	2.3	32%	2.0
Dry or Itchy Skin	36%	3.3	30%	3.2	34%	3.1
Pain in Upper Back	23%	2.5	22%	2.6	24%	2.6
Pain in Lower Back	27%	2.5	25%	2.7	24%	2.3
Pain in Shoulder/Neck	21%	2.6	21%	2.6	19%	2.5
Pain in Hands or Wrist	11%	2.6	11%	2.6	10%	2.6

\* Based on the total number of responding employees.

\*\* These percentages are based upon only the people who wear contact lenses at work (Part II, Question 1.a), as opposed to all responding employees.

Reference: Part II, Question 7.

headaches, stuffy nose, fatigue, and sleepiness in the week before the survey. Respondents indicated an average duration of between two and three days for most symptoms.

### **Comfort**

Overall, respondents were generally satisfied with their immediate physical workstations (chair comfort, lighting). This may be due to employees' ability to adjust these factors. For example, desk lamps are used regularly by 42-46 percent of respondents. Dissatisfaction with building-related factors, however, was reported in each building and at somewhat higher levels in Waterside Mall than in the other two buildings.

As one measure of dissatisfaction, for example, last year 48 percent of Waterside respondents reported bringing in portable fans to their offices, compared to 45 percent at Crystal and 36 percent at Fairchild. Waterside respondents also regularly made use of portable heaters in substantial numbers (22% of respondents). As Exhibit ES-6 shows, between 40 percent and 51 percent of respondents often or always wanted to adjust air movement, and between 38 percent and 55 percent of respondents often or always wanted to adjust the temperature.

In all three buildings, respondents reported the air to be often or always too dry rather than too humid, with too little as opposed to too much air movement. For example, in Crystal Mall, these reported percentages were 38 percent as opposed to 8 percent and 48 percent as opposed to 3 percent, respectively. The desire to adjust temperature was seasonally dependent in all three buildings, with respondents wanting to adjust temperature more during winter and summer. For example, over two-thirds of all respondents in Waterside Mall reported wanting to adjust temperature during winter and summer months.

Exhibit ES-7 breaks down these responses by Waterside Mall sector. A need for adjustments in air movement and humidity was reported most by respondents on the 2nd and 3rd floors of the Mall and the Southeast Mall. Temperature adjustments were desired most in the 2nd and 3rd floors of the Mall, West Tower, and Southeast Mall.

This report also outlines the findings of the survey regarding respondent background characteristics -- including employee demographic characteristics, health factors not related to the



**Exhibit ES-6: Number and Percent Reporting Often or Always Wanting to Adjust Environmental Comfort Last Year, by EPA Headquarters Building**

	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Adjust Air Movement	1,574	51%	210	46%	164	40%
Adjust Temperature	1,708	55%	174	38%	162	40%
Adjust Humidity	1,077	35%	160	35%	131	32%

Reference: Part III, Questions 1c, 1f and 1i.

**Exhibit ES-7: Number and Percent Reporting Often or Always Wanting to Adjust Environmental Comfort Last Year, by Waterside Mall Sector**

	WATERSIDE MALL SECTOR											
	EAST TOWER		WEST TOWER		MALL 2ND FLOOR		MALL 3RD FLOOR		NE MALL		SE MALL	
	N	%	N	%	N	%	N	%	N	%	N	%
Adjust Air Movement	759	45%	581	49%	392	61%	489	58%	432	51%	216	58%
Adjust Temperature	765	52%	594	59%	394	62%	491	59%	431	54%	221	57%
Adjust Humidity	756	33%	589	34%	392	40%	484	41%	429	33%	217	42%

Reference: Part III, Questions 1c, 1f and 1i.

buildings, job satisfaction and sources of stress, and the physical work environments in which employees work. These factors will be used in the Volume III analyses as background variables to help explain patterns of health symptoms and comfort problems. These analyses will provide a more detailed context in which to understand the differential health and comfort problems experienced by different types of employees, and employees in different buildings and sectors. The analyses will thus help to determine to what extent the health and comfort symptoms described in this report can be attributed to building conditions and to what extent they can be attributed to other independent factors.

## 1. INTRODUCTION

### 1.1 Background

The quality of the air and the work environment in office buildings has become an increasingly important issue. Workers in numerous modern, apparently well-designed office buildings have suffered ailments and discomforts that appear to be related to working in the buildings, whether from unacceptable indoor air quality, job characteristics, or other factors. Health concerns of workers in office buildings fall into several categories, including symptoms associated with indoor air quality, comfort concerns, and ergonomic symptoms. Indoor air quality symptoms refer to a complex mix of occupant reported symptoms associated with acute discomfort (e.g., headache, fatigue, stuffy nose, sinus congestion, eye irritation, sore throat) that improve while away from work. Comfort issues include concerns about air movement, temperature, humidity, odors, and physical comfort considerations (e.g., lighting, noise). Back pain/stiffness or pain/numbness in shoulders or hands are examples of symptoms associated with ergonomic stresses (repetitive motion or awkward postures).

Building related illnesses, another important potential health problem among office workers, are diseases that are caused by specific building-related etiologic factors. For example, hypersensitivity pneumonitis can be caused by bioaerosols produced by microbial contamination of ventilation systems, water-damaged rugs, furniture, or ceilings. This respiratory illness is characterized by infiltrates seen on chest x-rays and non-specific symptoms (fever, muscle aches, cough, and shortness of breath). Other building related illnesses include toxic effects of overexposure to chemical agents such as carbon monoxide (initial symptoms of headache and nausea) and dermatitis caused by fibrous glass which wears from ventilation duct linings. These symptoms can, of course, often occur for reasons unrelated to working in the building. Essential to the proper diagnosis of individuals with building related illnesses are physician evaluation and the measurement of environmental contaminants.

In recent years, employees in the three headquarters building complexes occupied by the U.S. Environmental Protection Agency (EPA) have expressed their concerns about indoor air pollution and work environment discomforts. Some of these concerns arose from incidents in which EPA employees became ill shortly after building renovations. Information continues to be

obtained by both labor and management on the health symptoms of EPA employees and the quality of indoor air at EPA headquarters. For example, both the National Federation of Federal Employees Local 2050 and the American Federation of Government Employees Local 3331 have accumulated information on the illnesses experienced by EPA employees. This information is provided in a supplement to this report entitled, "Additional Employee Adverse Health Effects Information."

In response to these continuing concerns, EPA decided to undertake a systematic study of the nature and spatial distribution of the employees' health symptoms and comfort concerns, and to attempt to determine if associations exist between employee responses and specific workplace conditions. This research effort was integrated with a parallel study at the Library of Congress Madison Building where employees were also reporting health symptoms and discomfort that they attributed to the building. The study team consisted of researchers from EPA, the National Institute of Occupational Safety and Health (NIOSH), the John B. Pierce Foundation at Yale University, and Westat, Inc., a health statistics consulting firm. The National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards, NBS) was engaged to study the Madison Building's ventilation system.

Both the EPA and the Library of Congress surveys made use of similar study designs and survey instruments, although separate reports are being prepared for each agency. While certain details are specific to the particular buildings involved, the survey design is applicable to a study of any building suspected of environmental problems.

This report documents the first part of a thorough investigation of indoor air quality at EPA headquarters. Specifically, this report documents the design of the study and the results of a survey conducted in February 1989 of all EPA employees working in three complexes: Waterside Mall and the Fairchild Building in Washington, D.C. and Crystal Mall in Arlington, Virginia. This report presents only a descriptive summary of the survey data. Results of the environmental monitoring and analyses of the entire study results will be presented in subsequent reports.

## 1.2 Study Objectives

The goal of this study is to characterize the extent of building-related health, comfort, and environmental problems at the three EPA headquarters buildings and to suggest remedies.

The indoor air quality research was conducted with the following four specific objectives.

1. Survey the nature, magnitude and spatial distribution of health symptoms and comfort concerns.
2. Characterize selected physical, chemical and biological aspects of the building in selected locations during the survey period.
3. Generate hypotheses from any associations observed between health and comfort effects and environmental factors while taking into account factors that would confound or modify such associations.
4. Identify areas not in compliance with standards or guidelines.

To fulfill Objective 1, a survey was conducted of all federal employees in the target buildings. To fulfill Objective 2, environmental monitoring was conducted for the following pollutants:

- nicotine;
- carbon monoxide;
- respirable particles (<2.5 micron);
- formaldehyde and other aldehydes;
- other volatile organic compounds, including 4-phenylcyclohexene (4-PC);
- pesticides;
- viable organisms (bacteria and fungi); and
- non-viable organisms (pollen and fungal spores).

Monitoring also was conducted for comfort related factors: carbon dioxide, temperature, humidity and airflow, as well as other ventilation parameters. At the time of the environmental monitoring, a second questionnaire was administered to persons working in the vicinity of monitoring stations in order to assess health and comfort concerns on the day of the survey. Objectives 3 and 4 will be fulfilled by an integrated analysis of all these bodies of data.

### 1.3 Study Reports

This report is the first of three reports documenting the study. This report addresses Objective 1; it presents detailed results of the questionnaire survey, including information about work-station design, health and comfort concerns, and potential related factors. Volume II will address Objective 2 and will report on environmental monitoring data collected in conjunction with the second, supplemental survey. Volume III will address Objectives 3 and 4 and will present a statistical investigation of the interrelationships among employees' responses, the environmental monitoring data, identified risk factors, and confounding factors.

This report is organized as follows. Chapter 2 presents a summary of the overall study design. Chapter 3 explains the survey methodology in detail. Chapter 4 summarizes the environmental monitoring methodology. Finally, the results of the survey are presented in Chapter 5. A series of appendices contains the questionnaires used in the surveys and additional data tables.

## 2. STUDY DESIGN

This chapter provides an overview of the study design developed and implemented at EPA headquarters. Section 2.1 describes the physical locations of the EPA buildings involved; Section 2.2 examines certain important issues that shaped the design of the study; Section 2.3 presents the conceptual design of the study and its major components. For additional discussion of the study design, see Chapters 3 and 4.

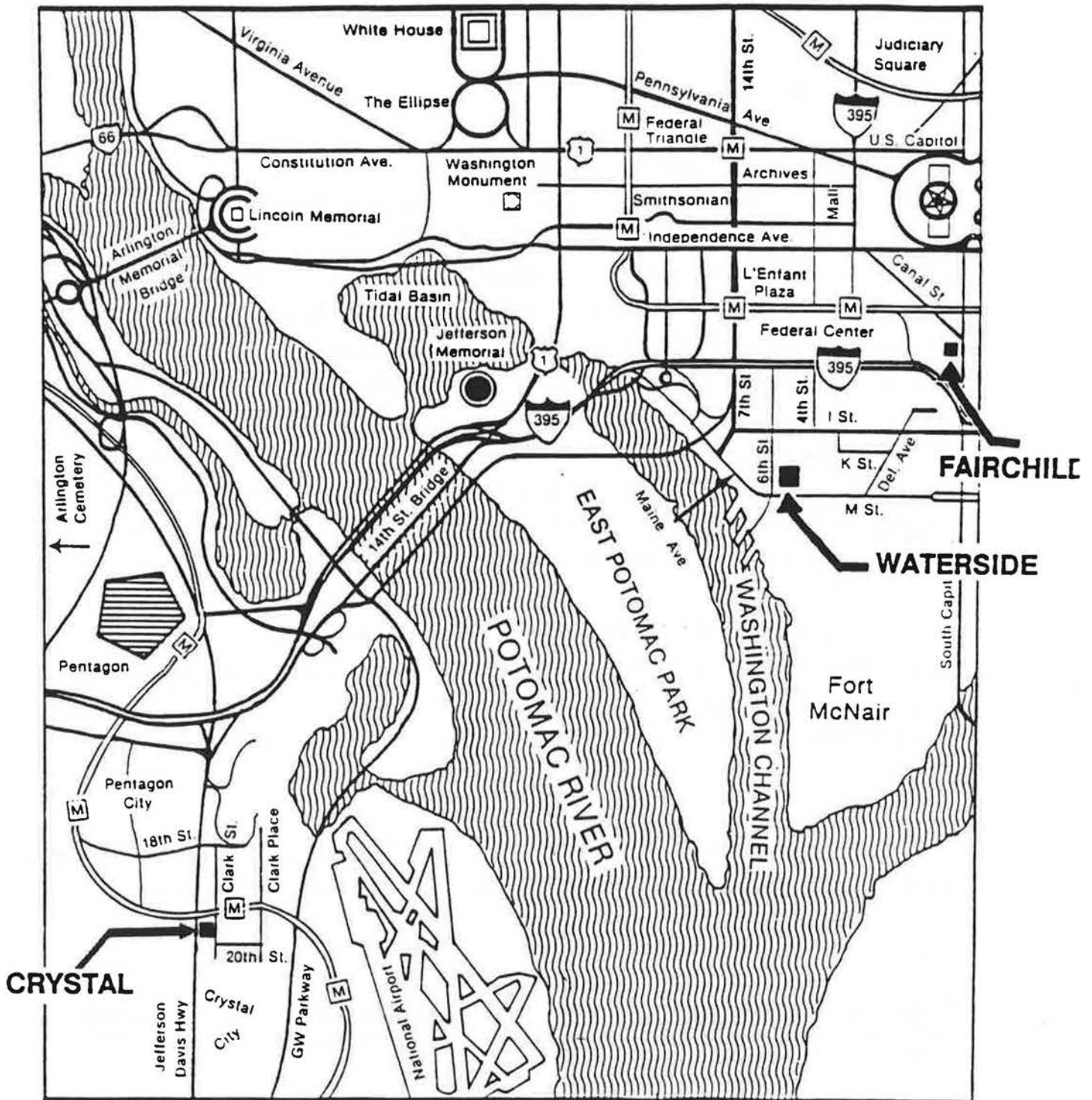
### 2.1 EPA Buildings

The three buildings that serve as EPA headquarters are located within a several-mile radius in the Washington, D.C. area (see Exhibit 2-1). Waterside Mall in Southwest D.C. was built in 1970, with EPA taking occupancy in 1971-72. At about the same time, a lease for office space in Crystal Mall 2, one of a complex of buildings in Crystal City, VA, was transferred to EPA. EPA occupancy of the Fairchild Building, located not far from Waterside Mall, dates from 1979-80.

Within Waterside Mall, a major objective of the study was to determine the spatial variation of health symptoms, comfort parameters, and odors. For this analysis, the building was divided into six "sectors": the East Tower, the West Tower, the second floor of the Mall, the third floor of the Mall, the Northeast Mall, and the Southeast Mall.

These sectors were chosen because they are reasonably homogeneous areas. For example, the two 12-floor Towers are basically separate buildings in themselves, being connected to the 3-story Mall only in the basement garage and by narrow passageways on the third floor of the Mall. The second floor of the Mall was designed for commercial occupancy; compared to the third floor, its ceilings are much higher and most of the partitions do not reach the ceiling. Therefore, air circulation patterns are likely to be different on the second floor of the Mall than on the third floor.

Exhibit 2-1: Map of Washington, D.C.





Unlike the Towers and Mall, the two remaining sectors of Waterside Mall were constructed in the 1980's. The Southeast Mall, an appendage to the second and third floors of the Mall, was constructed in the early 1980's. The Northeast Mall is the newest portion of the building, having been constructed during 1986-7. The Northeast Mall covers five floors (basement, ground, first, second, and third).<sup>1</sup>

## 2.2 Design Issues

The study objectives required a survey of employees to systematically collect information about their reactions to their work environments and environmental monitoring to ascertain the levels of environmental contaminants in the air and characterize ventilation parameters. Further, the objectives required that the survey and monitoring be conducted in a manner that permitted the detection of associations between the two sets of data at common locations. At the same time, there were several constraining factors and ancillary objectives present that influenced the ultimate study design. These influences are summarized here.

Inadequate Prior Data. Some information about employee health and discomfort complaints existed within the agency. However, there was little or no usable information on employee health or comfort problems that could be used as part of this study. Therefore, it was deemed necessary to design and conduct a survey of employees.

Need for Complete Enumeration. Ventilation, thermal factors and other conditions that influence health and comfort have great spatial variability. They can change sharply in a few feet. Consequently, a sample of employees may miss significant problems. This suggested that a complete enumeration be conducted with the 4,900 EPA employees in the three headquarters buildings.

Maximize Participation. There were a number of concerns about the employees' reactions to the survey. It was felt that the employees with complaints would be more likely to

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<sup>1</sup>A third, small area, the Southwest Mall, is attached to the second floor of the mall and was also constructed in the 1980's. Since the area is small (only 48 persons returned questionnaires from this area), it was decided to combine those responses with the remainder of the second floor of the Mall.

respond than those without complaints. It was necessary to approach the employees in a manner that encouraged participation by all employees.

Need for Confidentiality. The survey required the collection of sensitive data, and also required that respondents' workstation locations be identified. These factors generated a number of concerns about the privacy of employees' responses and, consequently, the participation rate. The employee unions wanted assurances that management would not be able to see any individual's data. All parties involved in the research felt that the participation rate would suffer without firm assurances of confidentiality.

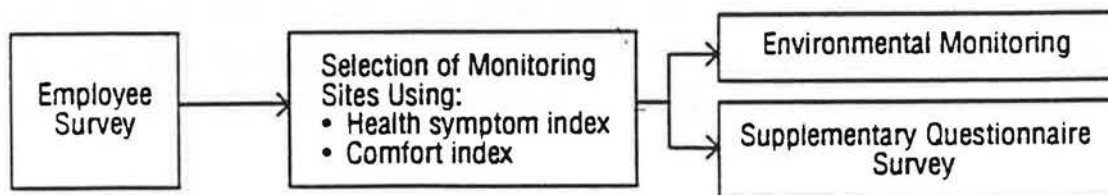
Limited resources. Available resources did not allow for telephone or in-person interviewing; it was therefore decided to design the questionnaire for self-administration. This, in turn, required minimizing: respondent burden, the potential for misunderstanding questions, effects of memory lapses, and potential for refusing to answer sensitive questions.

Also, since the number of sites that could be monitored was limited by the availability of resources and environmental monitoring equipment, it was decided to conduct the employee survey first, and to use the results to guide the selection of monitoring sites. To increase the ability to detect associations between survey information and environmental monitoring data, a second survey limited to employees in the vicinity of the monitoring equipment was also planned.

### 2.3 Conceptual Study Design

In view of these considerations, it was decided that the study objectives could be achieved most efficiently through the multi-pronged approach diagrammed in Exhibit 2-2 and outlined below.

**Exhibit 2-2: Conceptual Design**



## Employee Survey

A survey of employees in the target buildings was conducted in February 1989 using a self-administered questionnaire. The survey collected information about employees' health symptoms and comfort concerns, along with a number of possible risk factors and confounding factors. It thus yielded a detailed data base concerning EPA employee reactions to their workplace environment. The specific topics covered by the questionnaire included:

- Location of workstation (to enable the detection of associations between the survey and monitoring data);
- Description of workstation; both current and changes over the last year;
- Amount of time spent at workstation;
- Health symptoms experienced while in building, both in the previous week and last year;
- Other health effects and risk factors: contact lens and eyeglasses wear, smoking, allergies, asthma, etc;
- Eye, nose, throat, or respiratory irritation from tobacco smoke or other chemicals during last year;
- Gynecological problems during last year;
- Comfort issues: temperature, humidity, air movement, noise, dust, light, odors, and furniture during last year;
- Job characteristics, including job satisfaction and job stresses; and
- Education, job pay plan and grade, and job classification.

During the questionnaire's development, extensive reviews and pretests with debriefings were conducted. The pretests took place at a university library and another federal government agency. Pretesting was not conducted with Library of Congress or EPA employees in order to avoid any possible biases in the full-scale survey.

A broad array of techniques designed to enhance the participation rates was employed. Both management and unions were given the opportunity to review the draft questionnaire. Endorsements were secured from top management and union leaders and communicated to all employees prior to the survey. Employees were assured by management,

unions and the health contractor that their individual responses would not be revealed to management or union representatives. The questionnaires were distributed to the employees through their supervisors. However, questionnaires were returned in sealed envelopes directly to the contractor, not through labor or management. Those not responding in a timely fashion were prompted with friendly telephone calls. Announcements and reminders were posted throughout the building during the field period.

### **Selection of Monitoring Sites**

Findings from the employee survey were used to select approximately 100 locations for environmental monitoring. Rooms were selected for monitoring using a protocol developed for this purpose. To avoid possible biasing of the results, selections were made by the contractor independently of management, unions and the rest of the technical team. (A detailed description of the protocol is given in Section 4.1.) Briefly, a health symptom index was computed for each employee from the questionnaire responses, and a standardized mean symptom score was computed for each room in the building. Similarly, a comfort index was computed for each employee from the questionnaire responses and a standardized mean comfort score was computed for each room in the building.

Rooms were independently ranked according to the standardized health and comfort indices. Rooms were selected for environmental monitoring, starting with the rooms with the highest values for both indices and the lowest values for both indices. Results of these rankings were not revealed to the monitoring team. In the selection of rooms, greater priority was given to the health symptom index over the comfort index; and lesser priority was given to rooms with only one occupant.

### **Environmental Monitoring and Supplemental Survey**

The monitoring was conducted three weeks after the employee survey. All locations were monitored for temperature, relative humidity, carbon monoxide, and carbon dioxide. A subset of locations included measurements of nicotine, biological contaminants, particles, formaldehyde and other aldehydes, other volatile organic compounds (VOCs) and pesticides. In

addition, ventilation parameters were measured. See Chapter 4 for a detailed description of the monitoring.

A supplemental questionnaire was administered to all employees near the environmental equipment while the monitoring was on-going. "Near" was defined to include those within 30 feet of the monitoring carts, with no intervening walls. The supplemental questionnaire was, in large part, adapted from the portion of the original survey that collected information on employees' activities, health symptoms, comfort, and psychological state, in this case, on the same day as the monitoring.



### 3. EMPLOYEE SURVEY METHODOLOGY

This chapter describes in detail the methodology employed in the survey of EPA headquarters employees. The development of the questionnaire is described in Section 3.1. Section 3.2 describes the content of the questionnaire. Section 3.3 reviews the techniques used to maximize response rates and the results achieved. Section 3.4 describes the administration and collection of the questionnaires, and Section 3.5 describes the data preparation process.

#### 3.1 Development of the Employee Questionnaire

This section briefly describes the development of the employee survey questionnaire. A preliminary draft questionnaire was initially developed to explore in-depth associations between health symptoms and comfort concerns, and the work environment and indoor air quality for the Madison Building of the Library of Congress. The first draft of the questionnaire was 36 pages long and took 60 to 75 minutes to administer. Since overly long questionnaires tend to have lower response rates, it was decided to reduce the average administration time to no more than 30 minutes.

From October 1988 through January 1989, the draft questionnaire was thoroughly reviewed by experts in each subject area, and representatives of the EPA management and unions. All comments were studied by the Survey Design Team, which led to numerous revisions of the questionnaire. The final questionnaire was 20 pages long and met the goal of a 30-minute administration time.

The revision process began by prioritizing questions according to their relevance to the objectives of the study. Each question in the preliminary draft questionnaire was assigned a priority rating. Only those questions with the higher ratings remained in the questionnaire. Some questions that may not appear to be related to air quality and work environment were retained. These were questions that explore confounding factors, i.e., explanations for health symptoms other than indoor air quality.

A series of pretests and focus groups were designed and conducted to test and refine the questions, to explore the reliability of specific questions and the overall questionnaire, to discuss confidentiality issues, and to test the administration procedure. For the first pretest, a library setting was sought. The pretest was conducted at George Washington University Law Library in November, 1988. Volunteers from all job categories were asked to complete the questionnaire during the morning and participate in a focus group discussion of the questionnaire in the early afternoon. The focus group reviewed each question, the time required to fill out the questionnaire, and the problems of filling out a questionnaire at one's workstation.

The second and third pretests were conducted in December 1988 at the Department of Energy in order to test the relevance of the questions and procedure in a federal agency. These pretests involved two different groups of volunteers, separated by grade level in order to foster a more open discussion. Many of the comments and suggestions made by the pretest groups were incorporated into the final questionnaire, completed in January 1989. Appendix A contains the final employee questionnaire.

### **3.2 Content of the Questionnaire**

The questionnaire is divided into five sections. The first three sections address the primary issue: what is the spatial distribution of health symptoms and comfort concerns throughout the EPA headquarters buildings. Part IV is a section on job characteristics which addresses job satisfaction and indicators of stress in work and non-work activities. Part V includes demographic and other miscellaneous questions. Highlights of the contents of each part of the questionnaire are presented below.

#### **Part I. Description of Workstation**

##### **Potential Risk Factors**

Previous studies of office workers' health symptoms have identified certain risk factors associated with the workstation. Among these are textiles, which may collect dust or emit organic gases; partitions, which may emit formaldehyde and other organics; and office equipment,



such as copying machines, which may emit solvents or fumes from graphic processes<sup>1</sup>. Large amounts of paper have been shown to be a risk factor in previous indoor air studies<sup>2</sup>. Questions 7, 8, 9, and 11 collect information about these and other suspected or potential risk factors. Question 10, dealing with fans, air filters, heaters, and desk lamps is included to determine how many people have brought such additional equipment to work to adjust the comfort factors in their workstation. Question 12, on water leaks, is included because many investigations have identified humid conditions or water leaks as breeding grounds for molds, fungi, and bacteria that could cause building-related illnesses.

### Exposure

Part I includes questions that characterize the potential exposure of EPA headquarters employees to adverse environmental conditions while at their workstations (desk, office, cubicle, or primary work place). The workstation attributes explored include the following:

- Depending on the design, construction, maintenance, and evolution of the work space and the heating, ventilating, and air conditioning (HVAC) system, the type of physical space (question 1a) has been found to be critical to the indoor air quality of a particular space.
- Changes in workstation space configuration (question 11f) were reported.
- The type of space and space sharing information (question 1) was collected for comparison to information on comfort in Part III, especially question 1.
- Determination of temporal employment characteristics for each employee (questions 3, 4, 5, and 6) were made.
- Data on exposure (question 9), or remediation (question 10), from specific equipment were solicited.

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<sup>1</sup> Wallace, L.A., Pellizzari, E., Leaderer, B., Zelon, H., Sheldon, L. (1987). "Emissions of volatile organic compounds from building materials and consumer products," *Atmos. Environ.* 21:385-393.

<sup>2</sup> Skov, P. and Valbjorn, O. (1987) "Sick Building Syndrome in the Office Environment, the Danish Town Hall Study" *Indoor Air '87* Vol. 2, pages 439-443, Institute for Water, Soil and Air Hygiene, Berlin.

## **Part II. Information About Health and Well-being**

In order to explore the primary question of the geographic distribution of health symptoms and comfort concerns, health outcomes possibly associated with working in an indoor environment, as well as potential risk factors or confounders associated with the work environment, must be explored.

### **Health Outcomes**

Information was sought on the occurrence of a number of symptoms that have been reported by workers in previous evaluations of health effects of indoor air quality. Symptoms included were those related to nasal and mucous membrane irritation, respiratory effects, and other non-specific symptoms such as headache, fatigue, memory problems, tension, and depression (question 7).

Questions were included on several specific potential health hazards associated with the work environment such as the use of video display terminals (VDTs) and postural strains due to poorly designed workstations. Eye strain (question 7, parts j, k, l, and m) and muscle pains (question 7, parts cc through ff) assess the effects of these potential hazards.

Information was sought on the chronic occurrence of these symptoms by asking employees how often they experienced each symptom during the past year on a scale from "never" to "always" (question 7). To provide an estimate of more recent symptom occurrence, employees were asked how many days each symptom occurred in the week immediately preceding the survey. This information was indicative of a point prevalence in the winter season and was also used to select specific areas within the building for environmental monitoring. Finally, information was obtained in question 7 on whether each symptom changes when a person is not at work. As a general rule, for most symptoms, if the symptom is related to the work environment, it would be expected to improve when the person is not at work. Some exceptions to this general rule include muscle pains, which tend to get worse several hours after the irritating activity; hypersensitivity reactions, such as wheezing and shortness of breath; and immune responses that can be triggered by apparently small amounts of substances encountered at home or at work.

The frequency of symptom occurrence (question 7) was asked for each symptom. The severity of these symptoms was assessed by asking employees if any of these symptoms reduced their ability to work (question 8) or caused them to miss work (question 9).

Information was sought on the increased susceptibility of the employee to respiratory illnesses such as bronchitis and pneumonia (question 13) or other infections (questions 12 and 17) as a possible concern related to the indoor work environment. Questions regarding asthma (questions 15 and 16) were asked both to investigate the possibility of its occurrence as a result of the indoor environment and because, if present before employment in the building, it may be a risk factor for the occurrence of a number of symptoms included in the questionnaire.

A series of questions was included on irritation caused by a variety of fumes (questions 19 and 20) because of a number of previous reports in the Waterside Mall as well as from other work environments.

Information was sought on changes in the occurrence of symptoms in different seasons due to changes in environmental factors, such as ventilation, temperature, and humidity (question 10). This information can also be related to individual perceptions (obtained in Part III of the questionnaire) of these environmental factors.

A series of questions concerning gynecological health issues was included in the questionnaire, in response to employee concerns about gynecological symptoms that they attributed to working in the Waterside Mall complex. The gynecological questions (Questions 22 thru 31) dealt with:

- Regularity of the menstrual cycles;
- Accompanying menstrual symptoms;
- Physician diagnosed problems such as fibroids, cysts, or enlarged uterus; and
- Confounding factors such as pregnancy, nursing, menopause, and prescribed replacement or corrective hormones including birth control pills.

The questions were developed in consultation with health experts including epidemiologists and a gynecologist.

### **Other Related Health Characteristics**

Information was requested on a number of characteristics that can affect responses to the questions regarding health symptoms. Questions regarding the wearing of contact lenses and glasses (questions 1 and 2) are used in the analysis of questions regarding eye irritation and eye strain. Information was sought on the smoking of tobacco products (questions 3 through 6) to help analyze health outcomes such as those related to the respiratory system and mucous membrane irritation. Information was sought on employees with eczema (question 14) and allergies to pollens or animals (question 18). These individuals may be more likely to experience an allergic type response to some environmental factors. Finally, information was sought on age (question 21) and gender (question 22) since previous studies have shown that the occurrence of certain symptoms or the tendency to report the occurrence of symptoms may be related to age or gender.<sup>3</sup>

### **Part III. Information About Present Work Environment**

Indoor air quality attributes, such as air movement, temperature, humidity, stuffiness, odors, and dustiness, are the focus of many concerns about indoor air quality. Each of these physical comfort issues has been identified as likely contributing sources for many of the health symptoms mentioned in Part II such as mucous membrane irritation, respiratory irritation, headache, and fatigue.

#### **Air Quality**

- Questions 1, 2, 3 profile the complaints and perceived performance of the heating, ventilation and air-conditioning (HVAC) systems. The distributions of odors, for example, may help identify possible sources and HVAC solutions.
- Employees were asked how often they wanted to adjust air movement (question 1c), or temperature (question 1f), or humidity (question 1i). These questions contribute to analyzing the acceptability of the workstation. The responses may be helpful in identifying mitigation measures.

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<sup>3</sup> Op cit.

### Physical Comfort

- Information on noise and quiet (Question 1k and 1l) was collected for its potential relationship with health outcomes such as headache, fatigue, etc. (Part II), to job satisfaction (Part IV), and as a portion of the overall assessment of the physical environment.
- Information on lighting (questions 4, 5, and 6) relates to eye health (Part II), equipment use (Part I), and was used as a portion of the overall assessment of the physical environment.
- Access to daylight (question 6) and the necessity and frequency of taking fresh air breaks (question 9), are believed to be related to well-being (index from Part II) and stress management (Part IV). Question 9 was also part of the evaluation of the HVAC system.
- Information on the physical comfort of furniture (questions 7 and 8) was collected to see what role workstation design and ergonomics may play in the association of symptoms and comfort complaints, particularly eye and muscular health (Part II) and job acceptability (Part IV).
- Information was sought on the overall assessment of the physical environment (questions 10, 11, 12, and 13), including possible daily changes in the physical environment.

### Part IV. Characteristics of the Job

Job characteristics address issues which could possibly create stress. Stress is defined as "a disturbing imbalance between the job and the individual".<sup>4</sup> The work factors which can cause stress are called job stressors. Job stressors are work conditions which produce an acute effective, physiological or behavioral response. Stressors are important to an assessment of the work environment, because they are capable of producing symptoms that are similar to those associated with poor indoor air quality and therefore serve as potential confounders in this study. Questions in this section are combined to form scales to measure commonly occurring perceived job stressors:

- Job satisfaction: job stressors are often found to be highly related to reports of job satisfaction. A measure of global satisfaction was included to provide a rough index of overall job stress level (Question 1, parts a, b, c, and d). Specific aspects of satisfaction are assessed in questions 2 and 3.

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<sup>4</sup> Steven L. Sauter, L. John Chapman, Sheri J. Knutson. "Improving VDT Work: Causes and Control of Health Concerns in VDT Use," Lawrence, KS. (1985).

- Role conflict and role ambiguity are two of the most ubiquitous stressors found in modern work environments. Role conflict (question 4, parts a, b, and c) occurs when behaviors demanded by an individual's roles in an organization are incompatible. Role ambiguity (question 6, parts h, i, j, and k) refers to a lack of certainty regarding expected role behaviors.
- Job control (question 5, parts a, b, c, and d) has been associated with psychological and physical health complaints. This scale assesses control over workload, resources needed to do the job, policies and procedures at work, and workstation surroundings.
- Quantitative workload (question 6, parts a, b, c, and d) refers to the amount of work an individual has to do and the pace at which the individual must work. Quantitative workload is one of the most commonly assessed job stressors in the occupational stress literature and has been linked to a variety of health complaints.
- Underutilization of abilities (question 6, parts e, f, and g) measures the extent to which workers are required to use skills and knowledge in completing their work. Underutilization of abilities is a highly prevalent stressor thought to produce a variety of health complaints.
- External stressors (question 7) form an index of overall non-work demands. These are important to assess because non-work demands can increase the level and nature of work demands and vice versa. Work and non-work demands may interact to increase symptom reporting.

Job stressors act as confounders which complicate a determination of the cause of indoor air quality complaints. The particular questions and scales used in this section have already been validated in previous job stress studies and were chosen because of their reliability of measuring work and non-work stressors.<sup>5,6,7</sup>

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<sup>5</sup>Caplan, R.D., Cobb, S. French, J.R.P. Jr., Van Harrison, R. and Pinneau, S.R. (1975). Job demands and worker health. HEW Publication No. (NIOSH) 75-160.

<sup>6</sup>Quinn, R.P. and Staines, G.L. (1979). The 1977 Quality of Employment Survey, Institute for Social Research, University of Michigan, Ann Arbor, Michigan.

<sup>7</sup>Quinn, R.P. and Shepard, L.J. (1974). The 1972-73 Quality of Employment Survey: Descriptive statistics with comparison data from the 1969-70 Survey of Working Conditions. Ann Arbor: Survey Research Center.

## **Part V. Concluding Questions**

This section addresses basic demographic issues such as: living and financial arrangements; job, pay and educational classifications; and workstation location. Demographic issues such as job classification or education can help explain clustering of responses. Workstation location was asked so that responses could be related to environmental monitoring. Part V concludes with an opportunity for the respondent to volunteer anything else that concerns him or her about air quality or environmental health in the building. There were two major reasons for including this question. First, the questionnaire may have left out an important factor in health or environmental considerations. If enough respondents mention the same factor, then it both merits attention and may be important to include in future building studies. Second, an essay question gives respondents the opportunity to express any strong feelings or opinions that cannot be expressed within the structure of the questionnaire. Respondents were assured of the confidentiality of their responses to Part V, as well as to the entire survey.

### **3.3 Maximizing Respondent Participation**

A comprehensive plan was developed and implemented to maximize responses to the questionnaire:

- endorsement was secured from management and union leaders and communicated to all employees prior to the survey;
- management and union leaders reviewed a draft questionnaire and made comments;
- all employees were notified of the survey a few days before the distribution of the questionnaires;
- questionnaires were distributed through the supervisors;
- the questionnaires were tracked to ensure that every employee received one;
- confidential return of the questionnaires to the health statistics contractor was accomplished by the use of questionnaire return boxes maintained and collected only by contractor employees;
- a hot line was provided for all employees for questions regarding the questionnaire or its confidentiality;

- telephone calls were made to all employees to prompt non-participants to return their questionnaires; and
- reminders of the survey due dates were posted in designated locations in the building.

The plan assured that the questionnaire was approved by both management and the unions with the qualification that maximum precautions be taken to ensure confidentiality of the participants' responses. With this assurance, management and unions agreed to communicate their endorsement to all EPA personnel. As part of this effort, a letter was sent from the Administrator to supervisors explaining the nature of the survey, the contractor's role in the survey, and the procedure they were to follow in distributing the questionnaires to their staff (Exhibit 3-1). A second letter, included with the questionnaires, was sent to all employees from the outside researchers, introducing themselves and explaining the nature of the questionnaire and the procedure to be followed in filling out and returning the questionnaire (Exhibit 3-2). Included in the letter was the contractor's phone number that respondents could use for questions regarding the questionnaire or confidentiality.

Confidentiality was built into the protocols for the distribution, return, and review of the questionnaire. The questionnaire was delivered by supervisors in sealed envelopes to each employee with the assurance that neither they nor other EPA management would see the employee's responses. Once completed, the questionnaires were returned by the respondents in special, sealed envelopes to questionnaire return boxes located on each floor. The only identifying information on the questionnaire was an employee identification number used by the contractor in tracking and analyzing the data. This number and its association with an EPA employee was known only to the contractor and was used to keep track of questionnaire returns. The questionnaire return boxes were maintained and collected by the contractor. The questionnaires were taken to the contractor's facilities in Rockville, Maryland to be processed.

In order to encourage maximum response, telephone prompts were made on Wednesday and Thursday of the survey week. The telephone prompts asked the employees:

- If they had received a copy of the questionnaire;
- If they were in the process of completing the questionnaire;
- If they planned to fill out the questionnaire;



Exhibit 3-1: Letter to EPA Managers



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

[Feb. 8, 1989]

**MEMORANDUM**

OFFICE OF  
THE ADMINISTRATOR

**SUBJECT:** Indoor Air Quality and Work Environment Survey

**FROM:** John A. Moore  
Acting Deputy Administrator

**TO:** Senior Managers, Managers and Supervisors

We are implementing a three part approach to characterize our headquarters office indoor air quality in order to identify remedial actions. A study of the building's ventilation systems is almost complete; a monitoring effort measuring the level of air pollutants is scheduled for March and finally, all headquarter employees will be surveyed this month.

The third part of the approach requires your cooperation. On February 13, 1989, I want you to distribute an Indoor Air Quality and Work Environment Survey questionnaire to each member of your staff and provide them sufficient time to complete it (30-45 minutes). A 100% response rate is our goal. Because the survey is voluntary, your support is essential.

You will receive the questionnaire packets on February 10, 1989 from a Westat representative. Westat, a private health research firm, is administering the survey for EPA, so expect to be contacted by them. You should instruct your staff to take their completed questionnaires to "questionnaire return stations" located near the elevators and building exits. The questionnaire return station boxes will be picked up by Westat Staff and taken to Westat facilities to be opened and processed. The employees will be assured confidentiality; no one within EPA or the unions will be able to see individual responses. It is vital that you do not attempt to see any completed questionnaires.

The survey was developed by a team of senior scientists and statisticians from our Agency, AFGE and NFFE Unions, NIOSH, Yale University and Westat. It is representative of EPA's leadership in the development of methods for conducting indoor air investigations. The process of solving indoor air quality problems can be a slow one involving many trial and error steps before successful remedial actions are identified. I appreciate your assistance in the implementation of this survey, a critical step towards action.

For further information contact David Weitzman, Director, Environmental Health and Safety Division at 382-3640.

Exhibit 3-2: Letter Transmitting Questionnaire to EPA Employees



## Indoor Air Quality & Work Environment Study

February 9, 1989

Dear EPA Employee:

EPA's Office of Administration and Resources Management has asked Westat, Inc., a private health survey research firm, with the support of the John B. Pierce Foundation Laboratory at Yale University, to ask you some questions about the indoor air quality and work environment at the EPA headquarters buildings. Your participation is voluntary, but we encourage you to fill out the enclosed questionnaire and return it to Westat promptly - today, if at all possible. Your participation is needed, regardless of how satisfied you are with your work environment, to help clarify our understanding of the situation in your building.

It is important to answer the questionnaire as completely as possible. Some questions may not seem to be related to air quality issues but are needed to help us understand your total work environment. Your careful answers will ensure the accuracy of the information obtained.

Your questionnaire will be handled in a manner that ensures the strict privacy of your responses. The coded identifying number you see on the front of the questionnaire is there to provide a way to locate your workstation in your building. This is necessary so that your responses can be related to the upcoming environmental measurements. No one at EPA or the unions will be given any information that would allow them to trace or reconstruct an individual's identity.

PLEASE PUT THE COMPLETED QUESTIONNAIRE IN THE ENCLOSED RETURN ENVELOPE, SEAL IT, AND TAKE IT TO ONE OF THE "QUESTIONNAIRE RETURN STATIONS" NEAR THE ELEVATORS AND BUILDING EXITS. THESE BOXES WILL BE REMOVED FROM THIS BUILDING BY WESTAT STAFF AND WILL NOT BE OPENED UNTIL THEY REACH WESTAT'S FACILITIES.

We appreciate your participation in the survey. In a few weeks, air measurements will be taken at various locations within the EPA headquarters buildings. People who work near these locations may be asked a few more questions at that time.

If you need any assistance in completing the questionnaire, please contact Westat's field operations manager at 294-2845.

Sincerely,

Robert P. Clickner, Ph.D.  
WESTAT, Inc.

Brian P. Leaderer, Ph.D.  
John B. Pierce Foundation Laboratory  
Yale University

- If they did not plan to fill out the questionnaire, why not;
- If they did plan to fill out the questionnaire, they were reminded to fill it out and return it to the questionnaire return boxes by 3:00 pm on Friday; and
- If they had already filled out the questionnaire, they were reminded to return it to the questionnaire return boxes by 3:00 pm on Friday. Also, notices (Exhibit 3-3) were posted in designated locations in the building during the survey week reminding the participants to return their questionnaires by 3:00 pm on Friday.

Because the response rates were lower than anticipated as the end of the survey week approached, it was decided to extend the field period into the following week at all three EPA buildings. It is believed that the initial response rates were lower than anticipated in part because the questionnaires took longer than expected to be distributed to all employees and the Presidents' Day Holiday (Monday, February 20) slowed down the field effort.

### **Response Rates**

The overall response rate across all three buildings was 80.7 percent, with 3,955 of an estimated 4,900 EPA employees completing the survey. As shown in Exhibit 3-4, this response rate varied by building, gender, race, pay plan, and office.

- **Building:** Nonresponse varied from about 18 percent at Waterside Mall to 21 percent at Crystal City to 27 percent at the Fairchild Building. The higher nonresponse at Fairchild generally held up across gender, race, etc. categories.
- **Gender:** The nonresponse rate varied from about 16 percent for men to 21 percent for women. This gender difference was most pronounced at Fairchild.
- **Race:** Nonresponse varied from about 15 percent for whites, Asian-Americans and Hispanics to 30 percent for blacks. This held across buildings.
- **Pay Plan:** The nonresponse rates varied between less than 20 percent for executives and general schedule workers to 25 to 50 percent for part-time and other categories of workers.
- **Office:** Nonresponse varied from less than 10 percent at the General Counsel's Office to just over 20 percent at several other offices. Workers in Administration, Enforcement and Compliance, and Research and Development also had higher than average response rates.

**PLEASE RETURN ALL QUESTIONNAIRES BY  
FRIDAY, FEBRUARY 17.**

**This Questionnaire Return Station available continuously  
until 3:00pm on Friday.**

**Any questions? Call Westat at 294-2845.**

Exhibit 3-4: Survey Response Rates – Total and by Building

	All EPA Buildings			Nonresponse Rate (2)		
	Employees Surveyed (1)	Response Rate	Non-Response	Waterside Mall	Crystal Mall	Fairchild Building
<b>Total</b>	4,900	81%	19%	18%	21%	27%
<b>Gender</b>						
Women	2,586	79%	21%	19%	23%	34%
Men	2,268	84%	16%	15%	17%	20%
<b>Race</b>						
White, Nonhispanic	3,165	85%	15%	14%	17%	21%
Black, Nonhispanic	1,289	70%	30%	28%	33%	43%
Hispanic, Asian, etc.	446	83%	17%	17%	19%	13%
<b>Pay Plan</b>						
Senior Executive Service	138	80%	20%	22%	*	*
Merit Pay	1,021	85%	15%	14%	13%	20%
General Schedule	3,390	81%	19%	17%	21%	31%
Wage Grade	101	62%	38%	53%	*	*
Other	96	75%	25%	26%	*	*
Missing (3)	154	75%	25%	26%	*	*
<b>Office</b>						
Administration	134	82%	18%	19%	*	*
Air and Radiation	316	78%	22%	20%	*	28%
Administration & Resource Mgmt.	904	78%	22%	20%	*	25%
External Affairs	143	79%	21%	21%	*	*
Enforcement and Compliance	142	85%	15%	15%	*	*
General Counsel	136	93%	7%	7%	*	*
Inspector General	96	90%	10%	10%	*	*
Policy and Planning Evaluation	237	78%	22%	22%	*	*
Pesticides & Toxic Substances	1,147	81%	19%	18%	21%	*
Research and Development	287	88%	12%	12%	*	*
Solid Waste & Emergency Response	703	79%	21%	21%	*	*
Water	594	80%	20%	18%	*	38%

**Notes:**

- (1) The total number of employees who received questionnaires.
- (2) An asterisk (\*) indicates an insufficient sample size.
- (3) "Missing" refers to questionnaires in which pay plan data was missing or could not be interpreted.

An understanding of the sources of differential nonresponse and their impact on the survey results may become possible when detailed analyses of the survey data are performed.

### **3.4 Employee Survey Field Protocol**

This section presents the selection criterion for respondents and the protocols used by the field team in administering the survey.

The list of employees to be surveyed (the "frame") included all current full-time and part-time EPA employees located in the EPA headquarters buildings, as well as Senior Environmental Employees and an additional 12 EPA employees currently unable to work in Waterside Mall due to illnesses attributed to the building. The frame did not include on-site or off-site contractor employees and employees of other federal agencies. Two labels were generated for each employee. One label listed the employee's name, office number and supervisor; the other was a six digit ID with a bar code.

The questionnaire was designed to be self-administered. Contractor field staff distributed the questionnaires to EPA supervisors and collected the completed questionnaires from return station boxes. The field staff were responsible for the following tasks:

- Setting up the return station boxes in designated locations, exits and elevator lobbies;
- Transferring return station boxes to the contractor;
- Ensuring that envelopes containing completed questionnaires were not opened until they reached the contractor;
- Monitoring the return station boxes and locations in the building;
- Removing full boxes to designated areas;
- Reporting any problems, missing return station boxes, vandalism to return station boxes, etc; and
- Referring respondents with questions to the Field Operations Manager and returning completed questionnaires to questionnaire return station boxes.

The field staff distributed the questionnaire packets to the EPA supervisors at Waterside Mall on February 10. The survey began on February 13, when the Waterside Mall supervisors distributed the questionnaire packets to their staff. The questionnaire packets were distributed to EPA supervisors at Crystal Mall and the Fairchild building on February 17, who then distributed them to their staff on February 21.

Each packet contained the following:

- The questionnaire;
- Two letters, one explaining the purpose of the study, the second explaining the procedures to follow when the questionnaire was completed; and
- An envelope used by the respondent when returning the completed questionnaire to ensure confidentiality and privacy.

If there were problems with the distribution of the packets, the EPA supervisors contacted the field supervisors for assistance. Few problems occurred; most were the result of respondents relocated to another building, retired, recent hires or in some cases on annual or sick leave. Where necessary, field staff distributed copies of the questionnaire to respondents who did not receive one or misplaced the first copy. While the EPA supervisors distributed the questionnaire packets, the field staff set up questionnaire return station boxes in all the elevator lobbies throughout the building. There were approximately 75 return station locations in the Waterside Mall building, 5 return station locations in the Crystal Mall building, and 5 return station locations in the Fairchild building. The return station boxes remained in the elevator lobbies for the duration of the survey period and were monitored every hour by the field staff.

The monitoring was done to prevent vandalism and to identify any station that was at least half-filled with questionnaires. The quantity in the return station box was determined by lifting the station and gently shaking it. When a return station box was found to be at least half-filled, it was removed and replaced with an empty return station box. The half-filled return station boxes were taken to the field office, opened, and consolidated with the contents of other boxes. At the end of the day the filled return station boxes were transported to the contractor. Under no circumstances were the return station boxes or the completed questionnaires handled by anyone other than contractor personnel. Once at the contractor's offices, the return station boxes were

opened, the sealed envelopes were removed and opened, and the questionnaires were processed through receipt control.

### **3.5 Data Preparation**

Receipt control for questionnaires received at the contractor's headquarters was done by passing a bar code reader over the bar code on the front of each questionnaire. In a few cases where the respondent had altered, removed, or damaged the existing bar code, it was necessary to type in the correct ID number assigned to the respondent. After 50 ID numbers had been entered, a batch sheet was printed. The batch sheet had a batch ID number, the date, the code reader's initials, and a listing of all the ID numbers in that batch. The batch sheet was then attached to the questionnaires and the completed batch was sent to Key Entry for keying. The questionnaires were then keyed and 100 percent verified to minimize key entry errors.

Coding and editing were accomplished by the use of COED, a computer software system developed by the contractor for preparing and analyzing data for survey research studies using predesigned survey forms. After the data were key entered, an edit report was generated for each batch keyed. The coding staff reviewed the edit report, corrected any errors, and submitted the corrections to key entry to update the data files. This cycle of review was repeated three times. At various stages in the editing, the coding staff found responses that were not one of the response options provided in the questionnaire. In these instances, they would fill out a problem card for the supervisor, which the supervisor would review and assign a code. The file was then updated with the new code. The problem cards were filed by question number, making it possible to identify which questions were answered with a faulty response. If a "faulty" response was received often enough that it appeared to be a standard response, then it was added to the list of acceptable responses.

A review of the database resulted in finding and resolving various editing problems. This review indicated that there were 18 respondents whose symptom matrix was blank. That is, the respondent did not answer any part of Question 7 in Part II of the questionnaire. All 18 questionnaires were reviewed. It was discovered that these respondents had also failed to answer substantial portions of other parts of the questionnaire. It was decided to delete these 18 cases from the database.



In Question 4b, Part I (number of hours spent in building during a typical day), there were instances where the respondent indicated a response that was outside of an acceptable range. A formula was created to make the response fall within the acceptable range. Specifically, when the reported hours exceeded 16, the reported hours were divided by five, under the assumption that the respondent had interpreted the question to be about hours per week instead of hours per day. The same problem occurred with Questions 5, 9a, 9b, 9c, 9d and 9e, and had similar resolutions.

If a respondent reported having worked in the building before it was built, (Question 3a, 4a Part I), the response was changed to be no longer than the building's age.

In Question 7, Part II, there were instances when the respondent did not answer the first question for a particular symptom, but did go on and answer the second and third questions for that symptom. In each case, we imputed the response to the first part of the question as "rarely". Also, if the respondent answered "never" to the last year part, but for last week indicated one or more days, the response to last year was changed to "rarely". If a respondent failed to answer some symptoms in question 7 Part II, but responded to others, the missing symptoms were coded as "never".

For Question 5a in Part III there were instances when the respondent indicated "never", but went on to 5b and checked a response. For these cases, the response at 5a was changed to "sometimes".

There were instances where the respondent either failed to indicate or incompletely indicated a room number in Question 5a, Part V. In these instances, the room number from the EPA locator file was used in place of the respondent's response.



#### 4. ENVIRONMENTAL MONITORING METHODOLOGY

This chapter summarizes the environmental monitoring research component of the indoor air quality study at EPA headquarters. The summary includes a discussion of the methods used to select the monitoring sites (Section 4.1); the environmental monitoring design (Section 4.2); the methods followed in collecting air measurements (Section 4.3); and the supplemental employee questionnaire administered in conjunction with the monitoring (Section 4.4). The monitoring methodology will be presented in greater detail in Volume II of the study report. Volume II will also report on the monitoring data.

##### 4.1 Selection of Environmental Monitoring Sites

During the week after the administration of the comprehensive employee survey, a preliminary analysis of the questionnaires was performed in order to rank each room within the Waterside Mall complex by prevalence of health symptoms and thermal comfort complaints, and by number of occupants. Rooms with a high prevalence and those with a low prevalence of symptom or thermal comfort complaints were then provisionally selected for environmental monitoring. Those provisionally selected rooms which had a greater number of occupants were then selected for monitoring.

The specifics entailed in this selection protocol are presented below, first for health symptoms and then for thermal comfort.

##### Health Symptom Scores

- a. Even though all employees were included in the survey, the data used for site selection was limited to employees who reported working at their workstations four or more hours a day, on average.
- b. Symptoms were counted as positive if the following three criteria were met:
  1. reported to occur at least "often" in the past year;
  2. reported to occur at least 1 day in the past week; and
  3. reported to get better when away from work.

- c. Of the 33 symptoms listed in the questionnaire, 19 were grouped into the following four categories:
- Nasal:** runny nose, stuffy nose or sinus congestion, sneezing.
- Respiratory:** cough, wheezing or whistling in chest, shortness of breath, chest tightness.
- Mucous Membrane:** dry, itching, or tearing eyes, sore or strained eyes, burning eyes, sore throat, hoarseness, dry throat, problems with contact lenses.
- Non-Specific:** headache, unusual fatigue or tiredness, dizziness or lightheadedness, difficulty concentrating, difficulty remembering things.
- d. For each of the four symptom categories, if any symptom was positive (from b. above), then the symptom score for that category equaled 1. If no symptom within the category was positive, then the symptom score was 0.
- e. The total symptom score for each individual was calculated by summing the scores of each of the four symptom categories. The possible range of scores then was from 0 (no symptom category) to 4 (all symptom categories).
- f. For each room in the building, the mean health symptom score was calculated by summing the total symptom scores and dividing the total by the number of respondents in the room.

#### Thermal Comfort Scores

- a. A comfort score was computed for each of the four thermal comfort factors -- temperature, air movement, humidity and stuffiness. A score of 1 was given if there was "too much" or "too little" of a thermal comfort factor "often" or "always" in the previous week, with a score of 0 otherwise. These were added to obtain a "last week" thermal comfort score that ranged from 0 (no factors) to 4 (all thermal comfort factors).
- b. A "last year" score was calculated by giving a 1 if any of the four factors occurred "too much" or "too little" "often" or "always" in the last year, and 0 otherwise.
- c. The "last year" and "last week" scores were then added to obtain a thermal comfort scale with values from 0 to 5.

Combined Scores

- a. Two z scores were calculated, one for the mean symptom scores in each room, and one for the mean thermal comfort scores in each room:

$$z_i = \frac{(X_i - \bar{X}) (n_i)^{1/2}}{s_i}$$

where:

$X_i$  = mean symptom or comfort score for Room i

$\bar{X}$  = overall mean symptom or comfort score (all rooms)

$n_i$  = number of eligible respondents in Room i

$s_i$  = sample standard deviation of individual scores in Room i

If  $n_i$  equaled 1, the building-wide standard error estimate was substituted for  $s_i$  in the denominator. Similarly, if the variance of the mean symptom or comfort score was 0, i.e., all persons in a given room had the same score, then  $s_i$  was set equal to 0.35 (which is half the standard deviation if half the people had the same score and the other half had a score one unit above or below that score).

- b. Rooms were grouped into two size categories: one occupant, and 2 or more occupants. Within each room size category, the symptom and comfort z scores were separately ranked in order of magnitude.
- c. The following rooms were examined:
1. The 48 rooms with the highest symptom scores (z scores above +1.0) and two or more occupants (These 48 rooms included rooms with high, medium and low comfort scores);
  2. The 3 rooms with one occupant and with the highest symptom and thermal scores; and
  3. The 24 rooms with the lowest symptom and comfort scores (z scores below -1.0) and with two or more occupants.
- d. Each room chosen on these criteria was then visited by a team of industrial hygienists to assess its appropriateness for sampling. Depending on its size and layout, one or two areas within each room were selected and designated for sampling.

## 4.2 Environmental Monitoring Research Design

More than 120 potential monitoring locations from the various EPA buildings were identified and prioritized by building using the initial employee survey results. These locations represented both symptom and non-symptom areas in a ratio of 2:1. From these locations, three types of monitoring sites were identified:

- temporal sites, at which direct, instantaneous measurements were collected at one or more points in time;
- integrated sites, at which an integrated sample was collected over an entire workday, in addition to temporal measurements; and
- two fixed sites, one indoor and one outdoor, at which both integrated and temporal measurements were made each workday throughout the entire week.

A total of about 100 temporal and 50 integrated sampling sites were identified, with the integrated sample sites also being temporal sites. Sample collection occurred during normal employee working hours (between 7:00 am and 5:00 pm) during the week of March 6-10, 1989. On a typical day, samples were collected at the fixed indoor, fixed outdoor, up to 10 integrated indoor, and up to 20 temporal indoor monitoring locations.

Five categories of samples were collected each day:

- a. temporal measurements of carbon dioxide, carbon monoxide, temperature, relative humidity, and respirable particles were made at each temporal and fixed site three times daily (morning, midday, and afternoon);
- b. integrated 8-9 hour samples for volatile organic compounds (VOCs), nicotine, formaldehyde, and respirable particles were collected at each integrated and fixed sample location;
- c. viable and non-viable microbiological agents were also collected at each integrated and fixed sample location as well as various locations within the corresponding air handling systems supporting the monitoring locations;
- d. samples of aldehydes (2 per day) and pesticides (1 per day) were collected at selected integrated locations; and
- e. ventilation parameters (air flow, percent outside air, etc.) were measured for the primary air handling systems for the areas being monitored.

Exhibit 4-1 summarizes the environmental parameters monitored and the analytical methods used. Temporal parameters were measured using direct read-out instruments. Particulate matter was collected on 37 mm preweighed Teflon, filter media. VOCs, aldehyde, and pesticide samples were collected on evacuated electro-polished canisters, 2,4-dinitrophenylhydrazine coated silica-gel cartridges, and polyurethane foam cartridges, respectively. Formaldehyde and nicotine were collected at the monitoring stations using passive badges.

Gravimetric analysis of the particle samples followed standard EPA procedures. VOC samples were initially analyzed via gas chromatography - mass spectrometry (GC-MS) for targeted organic compounds, followed by a measurement of total non-methane hydrocarbons using gas chromatography - flame ionization detector (GC-FID). Pesticide samples were analyzed by gas chromatography - electron capture detector (GC-ECD) and GC-MS, while aldehydes were analyzed using high pressure liquid chromatography (HPLC). Nicotine samples were analyzed via GC equipped with a nitrogen-selective detector.

Samples for viable microbiological agents (fungi, thermophylic actinomycetes, and other bacteria) were collected at each integrated location using a single-stage impactor. The particles, impacted onto an appropriate medium, were thermally conditioned and grown to a size at which they could be counted. Non-viable samples (fungal spores) were collected over a 24-hour period at selected locations using a spore trap. Water samples were collected at HVAC systems. These samples were serially diluted, plated onto growth media, and incubated under appropriate temperatures to a size at which they could be counted.

#### **4.3 Air Measurement Methods**

This section describes the methods used to obtain air flow measurements at Waterside Mall during the week of March 6, 1989, through March 10, 1989. The air flow measurement results were obtained using methods recommended in the National Standards of the

**Exhibit 4-1. Environmental Monitoring Methodology**

Analyte	Sample collection	Analytical method
Carbon dioxide, Carbon monoxide	Direct measurement	Infrared analyzer
Temperature (°F), and relative humidity	Direct measurement	Psychrometer
Viable microbiological agents	Impaction onto agar	Incubation, colony count
Non-viable microbiological agents	Impaction onto greased tape	Spore count
VOCs*	Evacuated canister	GC-MS*, FID*
Respirable particles	Impaction & Direct Measurement	Gravimetric/ Light Scattering
Aldehydes	Coated silica gel	HPLC*
Pesticides	Polyurethane foam cartridge	GC-ECD*/GC-MS*
Nicotine	Coated filter (passive)	GC-nitrogen specific detector

- \* VOCs, volatile organic compounds  
GC, gas chromatography  
MS, mass spectrometry  
FID, flame ionization detector  
HPLC, high pressure liquid chromatography  
ECD, electron capture detector



Associated Air Balance Council (AABC). These standards are universally accepted as the most rational method for obtaining accurate data. Specific procedures followed were as follows:

Air Handling Units (AHUs) were inspected to determine the most representative location for velocity traverses. These locations are typically at the end of a long, straight duct run, prior to fittings, and as far as possible from the AHU fan. Holes were drilled in ducts for the velocity probe. The holes were drilled at a maximum of 8 inches on center, and smaller distances in the case of narrow ducts (under 24" wide). The minimum number of traverse points (number of traverse holes multiplied by the number of measurements per traverse hole) was 25.

The equipment used for velocity measurement was a 5/16 inch diameter pitot static probe (complying with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) specifications) and a high precision digital manometer. The pitot tube was configured to give velocity pressure measurements. The total pressure port of the pitot tube was connected to the high pressure side of the manometer, and the static pressure port of the pitot tube was connected to the low pressure side of the manometer. The velocity pressure readings were made at each traverse point. The first and last readings in the traverse were taken at a distance of 1/2 the centerline distance between the internal readings, as recommended by AABC.

The area of the duct is based on measurements of outside duct dimension, correcting for internal lining or external thermal insulation. Air flow, in cubic feet per minute (CFM), is determined by simple multiplication of the average velocity, in feet per minute (FPM), by the duct sectional open area, in square feet (SF). Average velocity was determined by first converting individual velocity pressure measurements to velocity, using the expression:

$$V = 4,005 \times (V_p) \exp(0.5)$$

where:

V = Velocity, feet per minute

V<sub>p</sub> = Velocity pressure, inches water column

Because of the near sea level elevation of the three buildings, no pressure correction factors were needed to account for air density differences. The air temperature correction factors published in the AABC National Standards were applied to the velocity measurements, however. Average velocity was the arithmetic average of all the corrected velocity readings for the traverses.

At certain large return air and mixed air plenums (particularly at the East and West Tower units), pitot traverses were impractical. Velocities were measured in these locations using a digital vane anemometer.

In some cases, there were no acceptable velocity traverse locations, primarily due to excessive turbulence in the air stream. In these cases, the dry bulb temperature method was relied upon for determination of ratio of outdoor air in the supply air stream. This ratio can be calculated using the following expression:

$$\%OA = \frac{T_{dbra} - T_{dbma}}{T_{dbra} - T_{dboa}} \times 100$$

where:

- %OA = Outdoor air percentage in AHU supply air
- T<sub>dbra</sub> = Dry bulb temperature of return air to AHU
- T<sub>dbma</sub> = Dry bulb temperature of mixed (return and outdoor) air to the AHU
- T<sub>dboa</sub> = Dry bulb temperature of outdoor air to AHU

The dry bulb temperature measurements were taken using a thermistor type temperature meter. Because of the relatively slow response time of this probe, it was allowed to "soak" in the air stream being measured for at least 5 minutes prior to reading data. This probe was kept in a conditioned environment when not actively used for data gathering, to minimize the lag in response. The measurement location for the temperature probe was selected to be as representative as possible. In the case of the mixed air, the most distant location from the point of air stream mixing was selected.

#### 4.4 Supplemental Questionnaire

A short follow-up questionnaire was designed to be administered to individuals located near to the environmental monitoring stations on the day of testing. The purpose of the questionnaire was to assess health and comfort status during the same period the environmental parameters were being measured. This questionnaire is provided in Appendix B.

The supplemental questionnaire is comprised of four sections:

1. **Description of Workstation:** These questions assess the amount of time an individual has been in the building and at his or her workstation on the day of testing, as well as the amount of time spent at tasks such as photocopying and working at video display terminals. In order to interpret some of the environmental measurements, individuals were also asked about the use of certain chemicals and processes in their work area.
2. **Information about Workstation Conditions:** These questions from the original questionnaire were slightly modified to assess an individual's perception of air movement, temperature, humidity, noise, and levels of stuffiness and dustiness. These perceptions were obtained from respondents separately for morning and afternoon periods in order to be correlated with environmental parameters measured throughout the day. Individuals were also asked about their perception of a variety of odors at their workstation during the day.
3. **Information about Health:** Individuals were asked to report on the occurrence of the same health symptoms included on the original questionnaire. For each reported symptom, respondents were asked if it occurred before arriving at work, during the morning while at work, or during the afternoon at work. This information was used both to assess the degree to which the symptom was directly work-related and to compare with other environmental parameters measured throughout the day.
4. **Mood:** A list of mood states was presented and respondents were asked to report whether they felt each mood "not at all" (scale position 1) to "extremely" (scale position 5). The 24 items were selected from the Profile of Mood States to assess fatigue, vigor, and tension states that could be affected by the quality of indoor air and other working conditions.<sup>1</sup>

#### Administration of the Supplemental Questionnaire

The procedure for administration of the supplemental questionnaire was dependent on the selection of monitoring sites as described above. Employees were eligible to receive the second questionnaire if they met the following criteria:

1. Their workstation was within 30 feet of the sampling station;
2. Their workstation was in an area not separated from the sampling station by a wall or other ceiling to floor barrier.

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<sup>1</sup>D.M. McNair, M. Lorr, and L.P. Droppleman (1971), "Profile of Mood States," P.O.M.S. San Diego, CA: Education and Industrial Testing Service.

A total of 369 employees completed the supplemental questionnaire at Waterside Mall, 42 at Crystal Mall, and 68 at the Fairchild Building. During the morning of the monitoring, employees due to receive the second questionnaire were identified and asked to participate in the monitoring segment of the study. They were given a brief description of the study and an official request to participate (see Exhibit 4-2). They were told that their area was to be monitored that day and that the survey staff would return at about 1:00 p.m. to distribute questionnaires which would record how they felt that day.

Employees who were not at their desks in the morning were left a notice telling them that the survey staff would return in the afternoon with the questionnaire. For individuals who were not at their desk when the survey staff returned in the afternoon, a questionnaire was left with instructions, with the completed form to be left on their desks in the accompanying sealed envelopes. These questionnaires were picked up around three in the afternoon. As many trips as were necessary were made to the workstations to collect all the questionnaires, whether completed or not by the end of the day. The receipt of the questionnaires was recorded and the questionnaires were sent to the health statistics contractor for processing.

Individuals were requested to provide their names on the front cover of the questionnaire, so that information from the supplemental questionnaire could be linked to the responses from the original questionnaire. As with all other personal information gathered in this study, confidentiality of these questionnaires was assured and maintained.

### **Survey Data Preparation**

When the questionnaires were received by the contractor, the names on the covers were matched with a list of all employees containing their names, workstation locations and the identification numbers assigned in the main survey. When a match was found, a label with a bar code for the ID was attached to the top of the inside first page. The cover with the name was then detached from the questionnaire. Receipt control was completed by reading the bar code on the questionnaire, in the same manner described in Section 3.5.

Exhibit 4-2: Supplemental Survey Description and Participation Request



## Indoor Air Quality & Work Environment Study

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### Follow-Up Survey

### EPA HEADQUARTERS Evaluation of the Workplace Environment

March 6 - 10, 1989

Dear EPA Employee:

Today Yale University and EPA scientists are conducting measurements of air quality in your work area. They are performing similar measurements throughout EPA headquarters this week. These measurements are being taken at areas selected by Yale and Westat investigators, through an analysis of the responses to the questionnaire we distributed two to three weeks ago. The presence of monitoring equipment in your area does not imply that there is an environmental problem in your area. That determination cannot be made until all of the study data has been analyzed.

As part of the environmental assessment of your work area, Westat is asking the employees in the immediate vicinity of the monitoring equipment to complete a brief questionnaire regarding how they feel TODAY.

LATER THIS AFTERNOON (between 1:00 and 3:00), a Westat representative will return to give you a questionnaire. At that time, please spend a few minutes to complete it. Please place it in the return envelope provided and seal it. The Westat representative will return a short time afterwards to collect it from you. If you will not be in your work area when the Westat representative returns, please leave the questionnaire on your desk.

Your completed questionnaire will be processed and analyzed by Westat and Yale investigators and WILL NOT BE SEEN BY ANY EPA EMPLOYEE.

We appreciate your participation in this important component of the Indoor Air Quality and Work Environment Survey of EPA headquarters. If you have any questions regarding the survey, please call the Westat survey hotline at 294-2845.

The questionnaires were keyed by the contractor, and were 100 percent verified to minimize key entry errors. The coding and editing was accomplished in a manner similar to the main questionnaire. (See Section 3.5.) The data file was reviewed and edited to identify and resolve data errors. With this short, pre-coded questionnaire, the only possible data problems were out-of-range codes.

## 5. EMPLOYEE SURVEY RESULTS

This chapter describes the findings of the employee survey conducted at the three EPA headquarters buildings. The primary focus of the chapter is on the health symptoms reported in the survey (Section 5.2) and on problems of comfort with the work environment (Section 5.3). The data in these two sections are presented for each headquarters building, and for the six building sectors in Waterside Mall identified in Chapter 3. It is recognized that not all buildings or building sectors have the same ventilation systems, environmental conditions, or types of employees or job classifications. More complete consideration of these potential risk factors will be presented in Volume III.

Following this presentation, Section 5.4 then summarizes the data collected in the survey on four sets of "background" variables -- (a) the demographics of the respondents (age, gender, education, etc.), (b) certain general health characteristics (such as use of corrective lenses, medical history of asthma, etc.), (c) job satisfaction and sources of job stress, and (d) physical characteristics of employees' workstations. Each of these background characteristics could prove useful in understanding or explaining the survey results when subsequent multivariate analyses of the data are conducted. Finally, Section 5.5 summarizes responses volunteered by employees to the "essay question" at the end of the questionnaire; here, respondents had the opportunity to describe building conditions and their experiences in their own words. To focus attention on the main findings, only selected exhibits are presented in this chapter. Additional exhibits referred to in this chapter are included in Appendix C.

### 5.1 Note on Data Presentation

No attempt is made in this chapter to explore associations between health or comfort outcomes and possible risk factors in the buildings. The data are presented below without accompanying analyses or conclusions about the causes of symptoms experienced or the degree to which the findings are "significant" compared to other buildings. In addition, it is important to note that the health symptoms and comfort concerns reported in the survey are self-reported by the respondents, and have not been verified by a physician's diagnosis as part of this study.

The primary reason for this approach is to avoid speculating on the causes of occupant concerns or the significance of the results presented until a complete analysis can be conducted. Multivariate analyses of associations are complex and require a lengthy and more detailed set of calculations. Volume III of this study will present such analyses (including monitoring results).

The tables of data presented in this chapter do compare the three EPA buildings, and in some cases, compare sectors within Waterside Mall. However, the buildings are considered as separate entities and do not serve as controls for each other. In other words, if results at all three buildings are roughly similar on any given question, this does not necessarily mean that all three buildings fall within some type of "normal" range.

As noted in Chapter 3, the overall response rate across all three buildings was 81 percent, with 3,955 of the estimated total of 4,900 EPA employees completing the survey. A maximum of 3,095 employees responded in Waterside Mall on any given question, out of a total of 3,770 (82%); in Crystal Mall, a maximum of 451 employees completed the survey (79% of an estimated 568); and in Fairchild, a maximum of 409 employees responded (73% of an estimated 562). Because not all respondents answered each question, many of the exhibits specify the number of employees responding to the particular question at hand. The impact of nonresponse on the survey results will be addressed in Volume III of this study.

## **5.2 Health Symptoms**

In order to identify health outcomes that might be related to conditions in the three EPA buildings, major emphasis is given here to a series of questions on 32 health symptoms that comes from Part II, Question 7 of the questionnaire (excerpted below). Respondents were asked to report how often they had experienced each symptom in the last year, how many days they had



experienced the symptom in the previous week, and whether the symptom typically changes when not at work:

7. Please answer the three questions to the right about each symptom listed below, even if you believe the symptom is not related to the building. (For each symptom, answer the first question. If the response is "never," go down to the next symptom.)	Please indicate how often during the LAST YEAR you have experienced this symptom while working in this building.					Please indicate how many days LAST WEEK you experienced this symptom while working in this building. (Fill in No. of days)	Does the symptom usually change when not at work?		
	Never	Rarely	Some-times	Often	Always		Gets Worse	Stays Same	Gets Better
a. headache	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. nausea	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. runny nose	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
d. stuffy nose/sinus congestion	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
e. sneezing	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
f. cough	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

It should be remembered that responses to these questions are based on self-perceptions of health and environmental conditions, which might not be verified by independent professional health experts or environmental scientists. In other words, like responses in other surveys, they are subject to the same types of limitations of human reporting due to faulty memory, incomplete recall and even distortion. At the same time, these are the types of perceptions that affect the way employees interpret their work environment and function in that environment. Respondents are, in other words, in an ideal position to report on their work environment and how it may affect their health and comfort.

### 5.2.1 Major Health Symptoms Experienced Last Year

Because most of the 32 symptoms are experienced by most people at some time, a symptom was considered in the tables that follow only if it was reported to have occurred either

"often" or "always" in the past year. Exhibit 5-1a shows the number and percentage of all respondents in each building who experienced each symptom "often" or "always" in the past year. (The complete tabulation of responses to this question is shown in Appendix C, Exhibits C-1a through C-1c.)

As Exhibit 5-1a shows, the symptoms reported to occur frequently are roughly similar across the three buildings -- contact lens problems (for contact lens wearers), stuffy nose, dry/itchy skin, dry/itching/tearing eyes, sore/strained eyes, headache, fatigue, and sleepiness. Differences do occur, however, across the buildings; for example, Waterside Mall respondents are more likely to report dry/itching eyes, dry throat, chills, dizziness, difficulty concentrating, and dry/itchy skin, than respondents at the other two buildings.

Larger and more consistent differences are found within the six sectors of Waterside Mall, as shown in Appendix C, Exhibit C-2. In general, respondents located on the 2nd and 3rd floors of the Mall and Southeast Mall report 3 to 10 percentage point higher rates of "often" or "always" experiencing certain symptoms, including headache, stuffy nose, coughing, dry eyes, sore eyes, double vision, burning eyes, fatigue, dry throat, contact lens problems, and dry/itchy skin.

To obtain a more focused perspective of health symptom problems, the concept of "cases" was used. Each case represents an employee who reported experiencing a health symptom "often" or "always" last year and whose health symptom reportedly got better when the employee left work. The use of the term case is intended to focus on employee symptoms that are recurring rather than occasional and that appear to be connected in some way to the building (in that respondents report that the symptom improves after leaving the building). This definition is similar to definitions of work-related symptoms used in previous studies.<sup>1,2</sup>

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<sup>1</sup>Finnigan, J.J., et al. "The Sick Building Syndrome: Prevalence Studies", *British Medical Journal*, 8 Dec 1984, pages 1573-1575.

<sup>2</sup>Skov, P., Valbjorn, O., and Pedersen, V., "Influence of Personal Characteristics, Job-related Factors and Psychosocial Factors on the Sick Building Syndrome", *Scandinavian Journal of Work Environment and Health*, 1989, 15; 286-295.

**Exhibit 5-1a: Number and Percent of Responding Employees Reporting Symptoms Often or Always Last Year, by EPA Headquarters Building**

SYMPTOMS	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Headache	650	21%	73	16%	80	20%
Nausea	64	2%	9	2%	9	2%
Runny Nose	533	17%	75	17%	70	17%
Stuffy Nose	960	31%	135	30%	122	30%
Sneezing	339	11%	45	10%	55	13%
Cough	254	8%	37	8%	32	8%
Wheezing	74	2%	15	3%	12	3%
Shortness of Breath	120	4%	15	3%	14	3%
Chest Tightness	80	3%	12	3%	14	3%
Dry, Itching, or Tearing Eyes	672	22%	79	18%	73	18%
Sore/Strained Eyes	647	21%	68	15%	87	21%
Blurry/Double Vision	204	7%	19	4%	25	6%
Burning Eyes	387	13%	46	10%	49	12%
Sore Throat	225	7%	25	6%	23	6%
Hoarseness	141	5%	14	3%	10	2%
Dry Throat	425	14%	38	9%	42	10%
Unusual Fatigue	643	21%	89	20%	66	16%
Sleepiness	609	20%	96	21%	70	17%
Chills	184	6%	7	2%	10	2%
Fever	23	1%	5	1%	2	0%
Aching Muscles	321	10%	54	12%	20	5%
Problems w/ Contact Lenses*	212	34%	17	24%	27	31%
Difficulty Remembering Things	196	6%	23	5%	13	3%
Dizziness/Lightheadedness	136	4%	10	2%	9	2%
Feeling Depressed	262	9%	40	9%	25	6%
Tension or Nervousness	400	13%	66	15%	40	10%
Difficulty Concentrating	310	10%	38	9%	26	6%
Dry or Itchy Skin	687	22%	76	17%	74	18%
Pain in Upper Back	331	11%	48	11%	39	10%
Pain in Lower Back	383	13%	57	13%	37	9%
Pain in Shoulder/Neck	326	11%	42	9%	35	9%
Pain in Hands or Wrist	164	5%	25	6%	12	3%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

As Exhibit 5-1b shows, the highest percentage of cases were reported for the same top seven symptoms across all three buildings (although ranked in different orders in each building):

- headache
- stuffy nose/sinus congestion
- dry, itching, or tearing eyes
- sore/strained eyes
- unusual fatigue or tiredness
- sleepiness or drowsiness
- contact lens problems (for contact lens wearers)

Each of these symptoms was experienced often or always by at least 10 percent of respondents and was reported to improve after the employee left work.<sup>3</sup> Most of these symptoms, most notably headache, fatigue, and those associated with mucous membrane irritation, have often been reported in published evaluations of indoor air quality.

It is, of course, possible that employees may suffer building-related symptoms that nevertheless persist, or even first appear, after the employee leaves work. Some symptoms, most notably pain in the back, neck, shoulders, hands or wrists, and symptoms possibly associated with delayed hypersensitivity reactions, such as wheezing and shortness of breath, even if work-related, may be expected not to improve when away from the building. In addition, some individuals may develop an immune response after exposure to certain substances encountered at work. Subsequent exposure to even very small amounts of these substances, whether at work or not, can then trigger an allergic response. Such symptoms might, therefore, not be expected to improve when away from work among this group of individuals.

Furthermore, employees may experience symptoms only "sometimes" that are nevertheless related to the building (for example, persons may be sensitive to paint fumes but may only "sometimes" be exposed to new paint near their workstations). Using the concept of a case may be considered by some as constituting a conservative estimate of health symptom problems. Therefore, for comparison, Exhibit 5-2a is provided, which shows the number and percent of responding employees reporting symptoms "sometimes", "often", or "always" last year. Similarly,

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<sup>3</sup>The figures in Exhibit 5-1b are derived as follows: For the first entry in Exhibit C-1a, for example, 91% of Waterside Mall respondents (2,810 out of 3,082 responding) reported that they had experienced headaches in the previous year – either rarely, sometimes, often, or always. Of these, 21% (or 650) experienced headaches often or always (Exhibit 5-1a). Of the 650, 478 (or 74%) also reported their headaches improved when they were not in the building (Exhibit 5-12). These 478 "cases" were then considered in relation to the total number of Waterside respondents (3,082). Dividing 478 by 3,082 gives the figure of 16% reported in Exhibit 5-1b.

**Exhibit 5-1b: Percent of All Respondents Who Had Symptoms Often or Always Last Year and that Got Better Upon Leaving Work, by EPA Headquarters Building**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Headache	16%	11%	16%
Nausea	1%	1%	1%
Runny nose	8%	9%	7%
Stuffy nose/sinus congestion	16%	17%	15%
Sneezing	7%	7%	8%
Cough	4%	5%	4%
Wheezing or whistling in chest	1%	1%	2%
Shortness of breath	2%	1%	2%
Chest tightness	2%	1%	2%
Dry, itching, or tearing eyes	17%	12%	15%
Sore/strained eyes	16%	12%	18%
Blurry/double vision	4%	3%	5%
Burning eyes	10%	8%	11%
Sore throat	4%	3%	4%
Hoarseness	3%	2%	1%
Dry throat	10%	7%	9%
Unusual fatigue or tiredness	15%	14%	11%
Sleepiness or drowsiness	15%	19%	13%
Chills	5%	1%	2%
Fever	1%	1%	0%
Aching muscles or joints	4%	4%	2%
Problems with contact lenses*	28%	19%	27%
Difficulty remembering things	2%	2%	2%
Dizziness/lightheadedness	3%	2%	1%
Feeling depressed	5%	5%	4%
Tension or nervousness	10%	11%	8%
Difficulty concentrating	7%	6%	5%
Dry or itchy skin	6%	4%	6%
Pain or stiffness in upper back	6%	6%	6%
Pain or stiffness in lower back	6%	6%	4%
Pain or numbness in shoulder/neck	6%	5%	5%
Pain or numbness in hands or wrists	2%	2%	2%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

**Exhibit 5-2a: Number and Percent of Responding Employees Reporting Symptoms Sometimes, Often or Always Last Year, by EPA Headquarters Building**

SYMPTOMS	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Headache	1,942	63%	239	53%	241	59%
Nausea	459	15%	62	14%	53	13%
Runny Nose	1,684	55%	227	51%	198	49%
Stuffy Nose	2,024	66%	277	62%	269	66%
Sneezing	1,532	50%	214	48%	196	48%
Cough	1,196	39%	169	38%	151	37%
Wheezing	306	10%	49	11%	37	9%
Shortness of Breath	460	15%	62	14%	45	11%
Chest Tightness	367	12%	58	13%	49	12%
Dry, Itching, or Tearing Eyes	1,565	51%	205	46%	200	49%
Sore/Strained Eyes	1,623	53%	223	50%	220	54%
Blurry/Double Vision	582	19%	76	17%	85	21%
Burning Eyes	1,134	37%	147	33%	134	33%
Sore Throat	1,103	36%	143	32%	114	28%
Hoarseness	644	21%	80	18%	69	17%
Dry Throat	1,164	38%	160	36%	138	34%
Unusual Fatigue	1,657	54%	227	51%	204	50%
Sleepiness	1,839	60%	260	58%	237	58%
Chills	737	24%	54	12%	73	18%
Fever	307	10%	31	7%	28	7%
Aching Muscles	983	32%	139	31%	110	27%
Problems w/ Contact Lenses*	443	71%	36	51%	53	60%
Difficulty Remembering Things	888	29%	130	29%	77	19%
Dizziness/Lightheadedness	736	24%	72	16%	61	15%
Feeling Depressed	1,042	34%	148	33%	118	29%
Tension or Nervousness	1,439	47%	215	48%	163	40%
Difficulty Concentrating	1,287	42%	174	39%	150	37%
Dry or Itchy Skin	1,469	48%	179	40%	162	40%
Pain in Upper Back	981	32%	134	30%	126	31%
Pain in Lower Back	1,194	39%	161	36%	146	36%
Pain in Shoulder/Neck	888	29%	121	27%	114	28%
Pain in Hands or Wrist	490	16%	71	16%	53	13%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

Exhibit 5-2b provides the percent of all respondents who had symptoms "sometimes", "often", or "always" last year that got better upon leaving work.

Exhibit 5-3 shows corresponding data for the six sectors of Waterside Mall. The same symptoms receive the most reports of cases. Again, the 2nd and 3rd floors of the Mall and the Southeast Mall report the highest percentages of problems, with 20 percent or more respondents reporting cases of stuffy nose/sinus congestion (3rd floor Mall); dry, itching, or tearing eyes (2nd floor Mall and Southeast mall); sore/strained eyes (2nd floor Mall); and sleepiness or drowsiness (Southeast Mall).

This information can be viewed another way in Exhibits 5-4 through 5-6 which group the symptoms into three categories:

1. Indoor Air Quality Symptoms (Exhibit 5-4), typically associated with acute discomfort, such as headache, runny nose, stuffy nose/sinus congestion, dry, itching, or tearing eyes, burning eyes, dry throat, fatigue, and sleepiness;
2. Respiratory or Flu-like Symptoms (Exhibit 5-5), which may be manifested in clinically defined illnesses that may require prolonged recovery times after leaving the building. Such symptoms include cough, wheezing, shortness of breath, chest tightness, fever, and aching muscles or joints; and
3. Ergonomic Symptoms (Exhibit 5-6), which include back pain or stiffness, and pain or numbness in the shoulder, neck, hands, or wrists.

In each exhibit, the average for Waterside Mall as a whole forms the basis of comparison for each of the Waterside sectors. Thus, for example, if a sector reported two percent variation for headaches, that would mean that respondents in that sector experienced a rate of headache cases 2 percent greater than the building as a whole, namely 16 percent plus 2 percent equals 18 percent. Negative percents in these exhibits indicate a lower than building average percentage of cases, while positive percentages indicate a higher than average level of cases. (Note that the rows do not sum across to zero because of different numbers of respondents in the six sectors.)

**Exhibit 5-2b: Percent of All Respondents Who Had Symptoms Sometimes, Often or Always Last Year and that Got Better Upon Leaving Work, by EPA Headquarters Building**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Headache	41%	30%	42%
Nausea	10%	7%	19%
Runny nose	20%	18%	15%
Stuffy nose/sinus congestion	29%	26%	29%
Sneezing	22%	20%	20%
Cough	14%	12%	12%
Wheezing or whistling in chest	4%	3%	2%
Shortness of breath	7%	5%	6%
Chest tightness	6%	12%	6%
Dry, itching, or tearing eyes	35%	29%	34%
Sore/strained eyes	37%	35%	40%
Blurry/double vision	12%	8%	14%
Burning eyes	27%	22%	27%
Sore throat	14%	12%	11%
Hoarseness	10%	6%	8%
Dry throat	23%	18%	23%
Unusual fatigue or tiredness	34%	32%	32%
Sleepiness or drowsiness	41%	42%	40%
Chills	16%	10%	11%
Fever	4%	3%	3%
Aching muscles or joints	10%	7%	9%
Problems with contact lenses*	47%	38%	46%
Difficulty remembering things	10%	8%	8%
Dizziness/lightheadedness	15%	17%	9%
Feeling depressed	19%	17%	15%
Tension or nervousness	32%	33%	28%
Difficulty concentrating	27%	27%	23%
Dry or itchy skin	12%	11%	11%
Pain or stiffness in upper back	16%	14%	18%
Pain or stiffness in lower back	16%	15%	19%
Pain or numbness in shoulder/neck	14%	12%	16%
Pain or numbness in hands or wrists	7%	6%	7%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.



**Exhibit 5-3: Percent of All Respondents Who Had Symptoms Often or Always Last Year and that Got Better Upon Leaving Work, by Sector in Waterside Mall**

SYMPTOM	WATERSIDE MALL SECTOR					
	EAST TOWER	WEST TOWER	MALL 2ND FLOOR	MALL 3RD FLOOR	NE MALL	SE MALL
Headache	14%	13%	18%	19%	16%	18%
Nausea	1%	1%	1%	2%	2%	14%
Runny nose	7%	9%	9%	10%	8%	8%
Stuffy nose/sinus congestion	15%	13%	16%	21%	16%	16%
Sneezing	6%	7%	7%	8%	7%	6%
Cough	4%	5%	6%	6%	4%	2%
Wheezing or whistling in chest	1%	1%	1%	2%	1%	2%
Shortness of breath	1%	2%	3%	3%	3%	2%
Chest tightness	1%	1%	3%	2%	2%	2%
Dry, itching, or tearing eyes	14%	15%	21%	18%	13%	20%
Sore/strained eyes	15%	14%	22%	18%	14%	19%
Blurry/double vision	4%	4%	7%	3%	3%	3%
Burning eyes	9%	10%	13%	11%	9%	10%
Sore throat	3%	3%	7%	5%	3%	9%
Hoarseness	3%	3%	5%	3%	2%	4%
Dry throat	8%	9%	15%	12%	8%	14%
Unusual fatigue or tiredness	12%	15%	17%	17%	12%	15%
Sleepiness or drowsiness	13%	14%	18%	17%	14%	20%
Chills	2%	5%	5%	5%	6%	4%
Fever	4%	0%	0%	1%	1%	5%
Aching muscles or joints	3%	4%	5%	5%	4%	6%
Problems with contact lenses*	24%	25%	45%	38%	31%	29%
Difficulty remembering things	2%	2%	3%	3%	3%	1%
Dizziness/lightheadedness	3%	2%	5%	4%	3%	4%
Feeling depressed	5%	5%	4%	5%	6%	5%
Tension or nervousness	9%	10%	12%	10%	9%	12%
Difficulty concentrating	6%	6%	10%	10%	6%	10%
Dry or itchy skin	6%	6%	8%	8%	6%	5%
Pain or stiffness in upper back	4%	8%	5%	7%	6%	4%
Pain or stiffness in lower back	4%	7%	4%	6%	7%	6%
Pain or numbness in shoulder/neck	4%	5%	6%	7%	6%	4%
Pain or numbness in hands or wrists	2%	2%	4%	2%	1%	2%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

**Exhibit 5-4: Variation in Distribution of Cases for Selected Indoor Air Quality Symptoms, by Waterside Mall Sector**

SELECTED SYMPTOM	WATERSIDE MALL AVERAGE	WATERSIDE MALL SECTOR					
		EAST TOWER	WEST TOWER	MALL 2ND FLOOR	MALL 3RD FLOOR	NE MALL	SE MALL
Headache	16%	-1.7%	-2.6%	2.3%	3.6%	-0.0%	2.4%
Runny nose	8%	-1.8%	0.4%	0.7%	1.5%	-0.4%	-0.9%
Stuffy nose/sinus congestion	16%	-0.9%	-2.9%	0.1%	4.2%	-0.5%	-0.4%
Dry, itching, or tearing eyes	17%	-2.2%	-1.7%	4.8%	1.7%	-3.4%	3.1%
Burning eyes	10%	-1.4%	-0.5%	2.8%	0.9%	-1.0%	-0.3%
Dry throat	10%	-2.1%	-1.1%	4.6%	1.7%	-2.1%	3.4%
Unusual fatigue or tiredness	15%	-2.3%	0.5%	2.7%	2.8%	-2.6%	0.7%
Sleepiness or drowsiness	15%	-1.8%	-1.6%	2.6%	2.1%	-1.0%	4.7%
<b>AVERAGE</b>		<b>-1.8%</b>	<b>-1.2%</b>	<b>2.6%</b>	<b>2.3%</b>	<b>-1.4%</b>	<b>1.6%</b>

Reference: Part II, Question 7.

**Exhibit 5-5: Variation in Distribution of Cases for Respiratory or Flu-like Symptoms, by Waterside Mall Sector**

SELECTED SYMPTOM	WATERSIDE MALL AVERAGE	WATERSIDE MALL SECTOR					
		EAST TOWER	WEST TOWER	MALL 2ND FLOOR	MALL 3RD FLOOR	NE MALL	SE MALL
Cough	4%	-0.8%	0.8%	1.2%	1.3%	-0.4%	-2.6%
Wheezing or whistling in chest	1%	-0.6%	-0.4%	0.1%	1.0%	0.2%	0.6%
Shortness of breath	2%	-1.0%	-0.2%	0.5%	0.8%	0.5%	0.2%
Chest tightness	2%	-0.2%	-0.6%	0.9%	0.2%	0.0%	0.2%
Fever	1%	3.3%	-0.1%	-0.3%	0.3%	0.1%	4.9%
Aching muscles or joints	4%	-1.4%	-0.3%	0.9%	1.0%	0.1%	1.6%
<b>AVERAGE</b>		<b>-0.1%</b>	<b>-0.1%</b>	<b>0.6%</b>	<b>0.8%</b>	<b>0.1%</b>	<b>0.8%</b>

Reference: Part II, Question 7.

**Exhibit 5-6: Variation in Distribution of Cases for Ergonomic Symptoms, by Waterside Mall Sector**

SELECTED SYMPTOM	WATERSIDE MALL AVERAGE	WATERSIDE MALL SECTOR					
		EAST TOWER	WEST TOWER	MALL 2ND FLOOR	MALL 3RD FLOOR	NE MALL	SE MALL
Pain or stiffness in upper back	6%	-1.8%	1.7%	-0.6%	0.8%	0.6%	-1.8%
Pain or stiffness in lower back	6%	-1.1%	1.1%	-2.1%	0.1%	0.9%	0.3%
Pain or numbness in shoulder/neck	6%	-1.4%	-0.7%	0.8%	1.9%	0.1%	-2.0%
Pain or numbness in hands or wrists	2%	-0.4%	-0.0%	1.4%	0.1%	-1.2%	-0.6%
<b>AVERAGE</b>		<b>-1.2%</b>	<b>0.5%</b>	<b>-0.1%</b>	<b>0.7%</b>	<b>0.1%</b>	<b>-1.0%</b>

Reference: Part II, Question 7.

As can be seen from the totals in each of these three exhibits, the 2nd floor Mall, 3rd floor Mall, and Southeast Mall have a higher than average proportion of cases for indoor air quality symptoms and respiratory or flu-like symptoms. The West Tower and 3rd floor Mall report the highest number of cases of ergonomic symptoms.

Respondents were asked if there was any seasonal variation in the symptoms they experienced. Exhibit C-7 displays these data. All three buildings exhibit the same seasonal relationships. About half of the respondents reported no seasonal variation in their symptoms, while nearly 40 percent reported that winter was their worst season.

At this time, however, any observed differences in symptom prevalence across buildings or building sectors cannot be attributed to any environmental factors. A more complete analysis, which will be reported in Volume III, will attempt to assess relationships between health outcomes and environmental measurements, taking into account a variety of other workplace and personal characteristics that may also be associated with health symptoms.

## **5.2.2 Other Health Symptoms Experienced Last Year**

In addition to the 32 symptoms, additional questions were asked of employees about certain clusters of symptoms. A separate set of questions asked women employees about gynecological problems. Findings include the following:

- **Flu-like symptoms, chest illness, wheezing, and asthma.** Exhibit 5-7 shows the number and percent of respondents reporting flu-like symptoms (such as wheezing, cough, shortness of breath, fever, chills, and aching muscles or joints - 25-28%); chest illness (17-24%), and wheezing without fever, sore throat, or chills (15-17%). Between 3 and 5 percent of respondents suffered asthma attacks last year. Few differences emerge among the buildings.
- **Gynecological Health.** The questionnaire asked women to provide information on issues of gynecological health. Results are reported in Appendix C, Exhibits C-3 to C-5. The older age profile of female respondents at Crystal is reflected in their responses to questions relating to pregnancy and menopause. Few differences appear among the three buildings in terms of respondents' reports of fibroids, cysts, and enlarged uteri (Exhibit C-5).

**Exhibit 5-7: Number and Percent of Responding Employees Reporting Ever Having Symptom Clusters Last Year, by EPA Headquarters Building**

SYMPTOM CLUSTER	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Flu-Like Symptoms	866	28%	119	27%	101	25%
Chest Illness	651	21%	106	24%	68	17%
Wheezing without Fever	465	15%	75	17%	61	15%
Asthma Attack	80	3%	21	5%	15	4%

Reference: Part II, Questions 12, 13, 15 and 16c.

### **5.2.3 Health Symptoms Experienced Last Week**

Respondents were asked on how many days last week they experienced the individual symptoms while working in the building. This question was thought to provide a more immediate, and perhaps more accurate, measure of the extent of symptom occurrence since the recall period was much more recent. In addition, this question was used to select sampling locations. The results, reported in Exhibit 5-8, show the percentage of respondents experiencing the symptom at least one day on the previous week among respondents; also shown are the average number of days respondents experienced the symptom in the last week. These percentages are based upon all those reporting symptoms whether or not those symptoms improved away from work; therefore, they are most likely over estimates of work-related symptoms.

In general, the results appear consistent with the relative ranking of symptoms in the previous year (Exhibit 5-1a) although the percentages reporting symptoms are much higher. This is not surprising, however, since the percentages of symptoms experienced during the past year represented only those who responded "often" or "always." Forty percent or more of respondents in each building reported experiencing headaches, stuffy nose, fatigue, and sleepiness. Respondents reporting symptoms in the week before the survey indicated an average duration of the symptom of between two and three days for most symptoms.

Exhibit C-6 shows symptoms reported in the previous week for the Waterside Mall sectors. Respondents in the 2nd floor of the Mall reported the highest percentage for 14 of the symptoms, followed by respondents in the Southeast Mall (highest on 10 symptoms), and West Tower employees (highest on 7 symptoms).

### **5.2.4 Effects of Health Symptoms on Work**

EPA employees were asked to assess the effects of their symptoms on their work. The data are summarized in Exhibit 5-9. Approximately one third of respondents indicated that their symptoms reduced their ability to work at least sometimes. Fairchild employees reported less effect of health symptoms on their work than the other two buildings (28% reported reduced ability to work sometimes, often, or always during the past year, compared to 38% for Crystal and 36% for Waterside). However, there was little difference among the buildings in the percentage of

**Exhibit 5-8: Percent of All Respondents Reporting One or More Days of Symptom and Average Symptom Days Last Week, by EPA Headquarters Building**

SYMPTOMS	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	% 1+ Days*	Avg. Days	% 1+ Days*	Avg. Days	% 1+ Days*	Avg. Days
Headache	53%	2.0	47%	2.0	49%	2.2
Nausea	13%	1.7	12%	1.7	13%	1.6
Runny Nose	42%	2.7	36%	2.8	36%	2.7
Stuffy Nose	51%	2.9	47%	3.0	51%	2.8
Sneezing	40%	2.3	38%	2.3	40%	2.4
Cough	31%	2.6	30%	2.5	30%	2.5
Wheezing	8%	2.5	7%	2.6	8%	3.0
Shortness of Breath	11%	2.4	10%	2.6	9%	2.4
Chest Tightness	9%	2.3	11%	2.4	9%	2.3
Dry, Itching, or Tearing Eyes	41%	2.6	35%	2.7	40%	2.6
Sore/Strained Eyes	41%	2.6	37%	2.5	44%	2.6
Blurry/Double Vision	16%	2.5	13%	2.6	17%	2.7
Burning Eyes	28%	2.5	23%	2.6	29%	2.5
Sore Throat	25%	2.2	22%	2.2	22%	2.1
Hoarseness	15%	2.3	13%	2.5	14%	2.1
Dry Throat	31%	2.6	25%	2.7	26%	2.6
Unusual Fatigue	44%	2.6	40%	2.7	43%	2.5
Sleepiness	50%	2.4	49%	2.6	48%	2.4
Chills	18%	2.4	9%	2.2	15%	2.2
Fever	8%	1.9	6%	2.6	8%	1.9
Aching Muscles	26%	2.5	26%	2.7	21%	2.4
Problems w/ Contact Lenses**	46%	2.8	39%	2.6	44%	2.3
Difficulty Remembering Things	21%	2.4	18%	2.2	19%	1.9
Dizziness/Lightheadedness	18%	2.0	13%	2.2	15%	1.8
Feeling Depressed	27%	2.2	26%	2.4	26%	2.3
Tension or Nervousness	37%	2.3	39%	2.6	35%	2.4
Difficulty Concentrating	33%	2.3	33%	2.3	32%	2.0
Dry or Itchy Skin	36%	3.3	30%	3.2	34%	3.1
Pain in Upper Back	23%	2.5	22%	2.6	24%	2.6
Pain in Lower Back	27%	2.5	25%	2.7	24%	2.3
Pain in Shoulder/Neck	21%	2.6	21%	2.6	19%	2.5
Pain in Hands or Wrist	11%	2.6	11%	2.6	10%	2.6

\* Based on the total number of responding employees.

\*\* These percentages are based upon only the people who wear contact lenses at work (Part II, Question 1.a), as opposed to all responding employees.

Reference: Part II, Question 7.



**Exhibit 5-9: Number and Percentage of Responding Employees Indicating Impact of Symptoms on Ability to Work Last Year, by EPA Headquarters Building**

	NUMBER	PERCENT RESPONDING				
		NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
<b>Symptoms Reduced Ability to Work</b>						
Waterside Mall	2,999	32%	32%	29%	6%	1%
Crystal Mall	430	32%	31%	31%	6%	1%
Fairchild	393	38%	34%	23%	4%	1%
<b>Symptoms Resulted In Staying Home or Leaving Work Early</b>						
Waterside Mall	2,967	44%	30%	23%	2%	*
Crystal Mall	429	46%	28%	22%	3%	*
Fairchild	387	50%	28%	21%	1%	*

\* 'Always' was not a possible answer in Question 9.

Reference: Part II, Questions 8 and 9.

employees who reported that their symptoms resulted in having to stay home or leave work early sometimes or often in the past year (22-25% at each building). The symptom most often mentioned as the reason for leaving work early or staying home was headaches (Exhibit C-8). Within Waterside Mall, more respondents in the 2nd floor Mall, 3rd floor Mall, and Southeast Mall said that their symptoms reduced their ability to work than did employees in other sectors of the building (Exhibit C-9).

### **5.2.5 Perceived Association of Symptoms with Building**

Employees were asked whether (a) they associated their health symptoms with conditions in the building; (b) felt that the conditions had improved over the year; and (c) had experienced more or less infections, or longer or shorter periods of infection, since working in the building.

As shown in Exhibit 5-10, 62 percent of Waterside employees associated one or more of their symptoms with the building they work in, compared to 56 percent of Crystal employees and 49 percent of Fairchild employees. Once again, within Waterside Mall, employees in the 2nd floor Mall, 3rd floor Mall, and Southeast Mall perceived a stronger association of their symptoms with the building than other sectors (Exhibit C-10). Most respondents in all three buildings found their symptoms neither improved nor worsened over the past year.

Another view of the association between symptoms and buildings is provided by Exhibit 5-11 which shows how respondents view the connection between their symptoms and the building. Here, the number of responding employees is the same as in Exhibits 5-1 to 5-6, but the comparison base is changed to include only employees who suffer from these symptoms often or always. (The bases are in Exhibit 5-1a.) Thus, for example, at Waterside Mall, of respondents who had headaches often or always last year, 74 percent found their headaches getting better when they left the building.<sup>4</sup> Similarly high percentages are found for other symptoms as well. In each building, for over half the 32 symptoms, over 60 percent of those who suffer frequently from the symptom implicitly attribute the symptom to the building.

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<sup>4</sup>In the case of headaches, 478 employees reported them often or always and also said the symptoms improved outside of work (see footnote 1 in this section). This number in relation to the total number of 650 employees suffering from headaches often or always is 74%. Other entries in Exhibit 5-12 are calculated in a similar way.

**Exhibit 5-10: Percentage of Responding Employees Associating Symptoms with Building Last Year, by EPA Headquarters Building**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Percent Associating Symptoms with Building	62%	56%	49%
Symptoms Improved over the Last Year	11%	8%	8%
Symptoms became Worse over the Last Year	29%	26%	24%
Symptoms Remained the Same	60%	66%	68%
Employees Responding	2,922	418	379

Reference: Part II, Question 11.

**Exhibit 5-11: Percent of All Respondents Whose Symptoms Get Better Upon Leaving Work, Among Those Who Have Symptoms Often or Always, by EPA Headquarters Building**

SYMPTOM	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Headache	74%	67%	71%
Nausea	67%	56%	44%
Runny nose	48%	53%	41%
Stuffy nose/sinus congestion	51%	54%	48%
Sneezing	59%	67%	58%
Cough	52%	57%	50%
Wheezing or whistling in chest	50%	20%	58%
Shortness of breath	52%	40%	71%
Chest tightness	63%	33%	71%
Dry, itching, or tearing eyes	75%	68%	84%
Sore/strained eyes	77%	79%	84%
Blurry/double vision	70%	74%	76%
Burning eyes	80%	78%	90%
Sore throat	60%	52%	65%
Hoarseness	71%	79%	60%
Dry throat	73%	79%	90%
Unusual fatigue or tiredness	69%	69%	70%
Sleepiness or drowsiness	75%	86%	74%
Chills	76%	43%	90%
Fever	74%	80%	50%
Aching muscles or joints	39%	30%	45%
Problems with contact lenses*	82%	65%	67%
Difficulty remembering things	36%	43%	77%
Dizziness/lightheadedness	72%	70%	67%
Feeling depressed	59%	60%	60%
Tension or nervousness	75%	71%	80%
Difficulty concentrating	73%	71%	81%
Dry or itchy skin	29%	24%	34%
Pain or stiffness in upper back	54%	58%	64%
Pain or stiffness in lower back	44%	47%	49%
Pain or numbness in shoulder/neck	52%	55%	60%
Pain or numbness in hands or wrists	44%	28%	58%

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

As in Exhibit 5-1b, Waterside Mall employees show higher figures than the other two buildings for headaches, nausea, and contact lens problems. Crystal City employees report higher figures on runny nose, stuffy nose, sneezing, cough, hoarseness, sleepiness and fever. For 20 of the 32 symptoms, however, it is the employees at Fairchild (who report symptoms often or always) who most often report their symptoms getting better when they leave the building.

More Waterside employees than in either of the other two buildings reported that both the frequency and duration of their infections (e.g., colds, flu, bronchitis, etc.) had increased since they began work in the building. As Exhibit 5-12 shows, 39 percent of respondents at Waterside reported more frequent infections (compared to 31% and 23% for Crystal and Fairchild, respectively), and 36 percent of Waterside respondents reported longer lasting infections since beginning work in the building (compared to 31% and 23% for Crystal and Fairchild, respectively).

#### 5.2.6 Potential Sources of Irritation

Respondents were questioned about nine possible sources of eye, nose, throat, and respiratory irritation. As Exhibit 5-13 shows, paint and tobacco smoke were mentioned among the top four sources in all three buildings. At Waterside Mall, fumes from new carpeting, paint, and tobacco smoke were mentioned as the three leading candidates for cause of irritation. Crystal respondents were more likely to identify paint fumes, tobacco smoke, and fumes from copy machines. Fairchild respondents pointed primarily to new carpeting, tobacco smoke, and fumes from new drapes and paint. (Complete tabulations of responses are shown in Exhibit C-11. See also Exhibit C-21 which shows that about 30% of respondents in each building report having a special sensitivity to eye, nose, throat, or respiratory irritants.)<sup>5</sup>

Exhibit 5-14 profiles the three most commonly reported sources of irritation at Waterside Mall, showing the variation by sector. Southeast and both floors of the Mall have the greatest percentages of employees associating irritation to new carpets and paint. Southeast, Second Floor Mall and West Tower have the greatest percentages of employees irritated by

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<sup>5</sup>Note that these exhibits count "sometimes" responses in addition to "often" and "always" responses. This is because of the episodic nature of many of these irritants. In other words, the causes of irritation may occur relatively infrequently (such as new carpeting) but when they do occur, they may produce considerable irritation or discomfort.

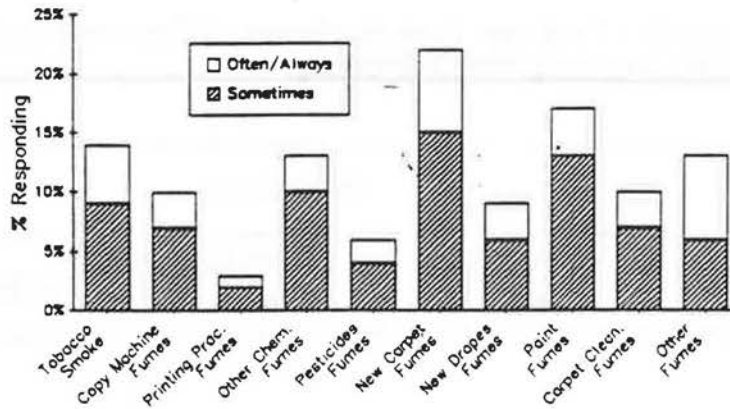
**Exhibit 5-12: Percent of Responding Employees Reporting Increased Frequency and Duration of Infection\* Since Beginning Work at Building**

	BUILDING		
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Percent Having Infections:</b>			
More Frequently	39%	31%	23%
Less Frequently	5%	7%	9%
Same Frequency	56%	62%	67%
Employees Responding	2,989	433	396
<b>Percent Whose Infections:</b>			
Last Longer	36%	31%	23%
Last Shorter	3%	4%	4%
Last the Same	61%	65%	72%
Employees Responding	2,935	428	382

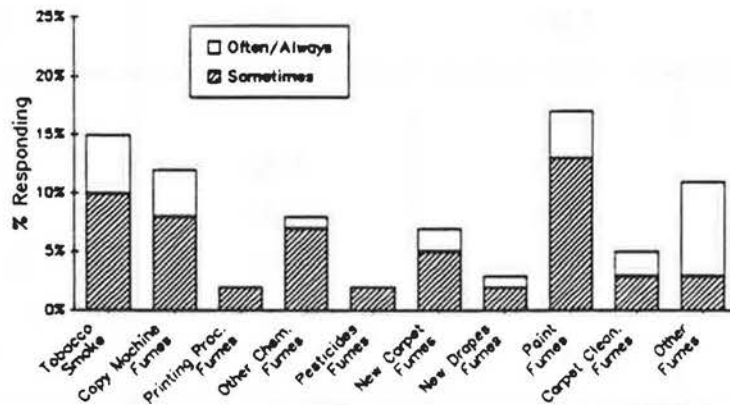
\*"Infections" refer to colds, flu, bronchitis, etc.

Reference: Part II, Question 17.

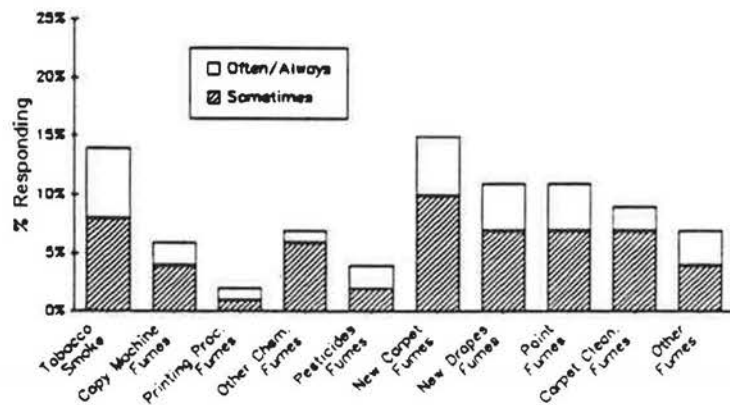
**Exhibit 5-13a: Percent of Responding Employees Attributing Eye, Nose, Throat or Respiratory Irritation to Various Causes at Workstation Last Year – WATERSIDE MALL**



**Exhibit 5-13b: Percent of Responding Employees Attributing Eye, Nose, Throat or Respiratory Irritation to Various Causes at Workstation Last Year – CRYSTAL MALL**

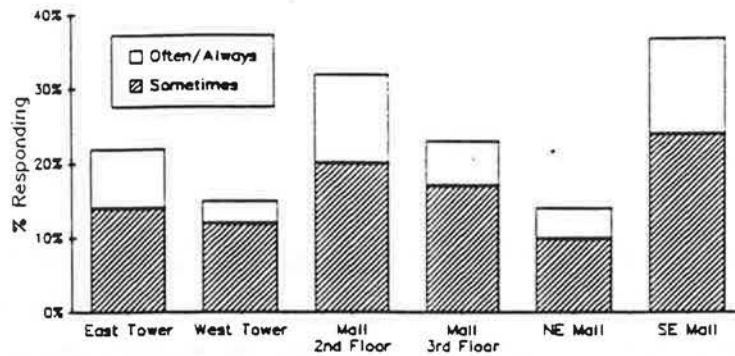


**Exhibit 5-13c: Percent of Responding Employees Attributing Eye, Nose, Throat or Respiratory Irritation to Various Causes at Workstation Last Year – FAIRCHILD BUILDING**

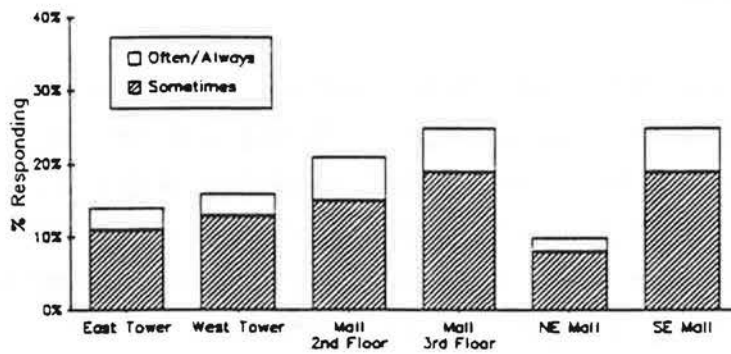


Reference: Part II, Question 19.

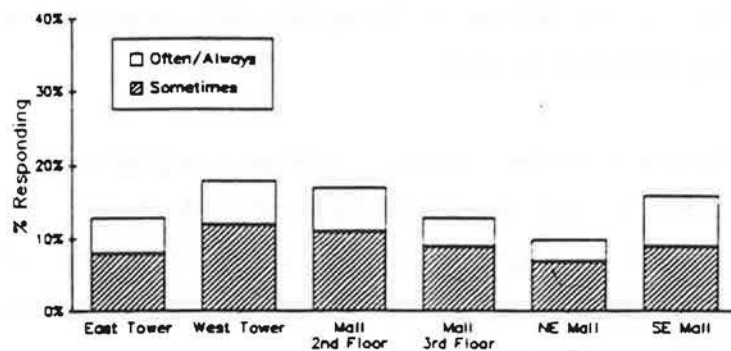
**Exhibit 5-14a: Percent of Responding Employees Attributing Eye, Nose or Throat Irritation to New Carpet Last Year, by Waterside Mall Sector**



**Exhibit 5-14b: Percent of Responding Employees Attributing Eye, Nose or Throat Irritation to Paint Last Year, by Waterside Mall Sector**



**Exhibit 5-14c: Percent of Responding Employees Attributing Eye, Nose or Throat Irritation to Tobacco Smoke Last Year, by Waterside Mall Sector**



Reference: Part II, Question 19.



tobacco smoke. It should be noted that EPA headquarters' smoking policy permits smoking only in designated rest rooms.

### **5.3 Comfort Issues**

This section reports on the comfort level experienced by respondents in working at EPA headquarters buildings. Two aspects of comfort are dealt with separately -- comfort associated with indoor air quality (e.g., how one feels about the temperature, stuffiness, odors, etc.), and comfort related to the physical environment (as in the ergonomics of the workstation, the comfort of the chairs, etc.).

#### **Air Quality Comfort**

A complete tabulation of responses to questions on air movement, temperature, humidity, noise, and dust is presented in Exhibits C-12 and C-13 for each building and by Waterside sector. An extract of key comfort concerns is displayed in Exhibit 5-15, which shows that between 40 percent and 51 percent of respondents often or always wanted to adjust air movement in their buildings, between 38 percent and 55 percent often or always wanted to adjust the temperature, and between 32 percent and 35 percent often or always wanted to adjust humidity. In all three buildings, respondents reported the air to be often or always too dry rather than too humid, with too little as opposed to too much air movement. For example, in Crystal Mall, these reported percentages were 38 percent as opposed to 8 percent and 48 percent as opposed to 3 percent, respectively. The desire to adjust temperature was seasonally dependent in all three buildings, with respondents wanting to adjust temperature more during winter and summer. For example, over two-thirds of all respondents in Waterside Mall reported wanting to adjust temperature during winter and summer months.

Exhibit 5-16 breaks down the responses by Waterside Mall sectors. Lack of air movement appears most prevalent in the 2nd and 3rd floors of the Mall and the Southeast Mall; temperature adjustments are most often desired in the 2nd and 3rd floors Mall, West Tower and Southeast Mall (Exhibit C-13). Changes in physical conditions are most desired in the winter and summer seasons (Exhibit 5-17).

**Exhibit 5-15: Number and Percent Reporting Often or Always Wanting to Adjust Environmental Comfort Last Year, by EPA Headquarters Building**

	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Adjust Air Movement	1,574	51%	210	46%	164	40%
Adjust Temperature	1,708	55%	174	38%	162	40%
Adjust Humidity	1,077	35%	160	35%	131	32%

Reference: Part III, Questions 1c, 1f and 1i.

**Exhibit 5-16: Number and Percent Reporting Often or Always Wanting to Adjust Environmental Comfort Last Year, by Waterside Mall Sector**

	WATERSIDE MALL SECTOR											
	EAST TOWER		WEST TOWER		MALL 2ND FLOOR		MALL 3RD FLOOR		NE MALL		SE MALL	
	N	%	N	%	N	%	N	%	N	%	N	%
Adjust Air Movement	759	45%	581	49%	392	61%	489	58%	432	51%	216	58%
Adjust Temperature	765	52%	594	59%	394	62%	491	59%	431	54%	221	57%
Adjust Humidity	756	33%	589	34%	392	40%	484	41%	429	33%	217	42%

Reference: Part III, Questions 1c, 1f and 1i.

**Exhibit 5-17a: Number and Percent of Employees Responding Wanting to Adjust Physical Conditions, by Season -- WATERSIDE MALL**

	NONE		WINTER		SPRING		SUMMER		FALL	
	N	%	N	%	N	%	N	%	N	%
Air Movement	339	11%	1,729	56%	1,126	36%	2,126	68%	1,071	34%
Temperature	125	4%	2,178	70%	1,000	32%	2,124	68%	974	31%
Humidity	656	21%	1,514	49%	695	22%	1,460	47%	679	22%
Odors	1,558	50%	758	24%	596	19%	927	30%	574	19%

**Exhibit 5-17b: Number and Percent of Employees Responding Wanting to Adjust Physical Conditions, by Season -- CRYSTAL MALL**

	NONE		WINTER		SPRING		SUMMER		FALL	
	N	%	N	%	N	%	N	%	N	%
Air Movement	64	14%	234	52%	156	34%	311	69%	152	34%
Temperature	43	10%	272	60%	123	27%	302	67%	118	26%
Humidity	104	23%	247	55%	100	22%	183	40%	93	21%
Odors	251	55%	111	25%	82	18%	134	30%	84	19%

**Exhibit 5-17c: Number and Percent of Employees Responding Wanting to Adjust Physical Conditions, by Season -- FAIRCHILD BUILDING**

	NONE		WINTER		SPRING		SUMMER		FALL	
	N	%	N	%	N	%	N	%	N	%
Air Movement	71	17%	217	53%	124	30%	241	59%	115	28%
Temperature	35	9%	272	66%	110	27%	242	59%	106	26%
Humidity	113	28%	186	45%	76	19%	169	41%	79	19%
Odors	238	58%	80	20%	60	15%	104	25%	55	13%

Reference: Part III, Question 3.

Employees were asked how often they took fresh air breaks. As shown in Exhibit C-36, nearly half of all employees in all three buildings take fresh air breaks one to four times per week, while over 20 percent of Waterside Mall and Crystal Mall employees take fresh air breaks more than five times a week.

Exhibit 5-18 shows the frequency with which respondents "sometimes," "often," or "always" noticed different types of odors at their workstations, by building. (Again, "sometimes" responses are included in these exhibits because of the episodic nature of the Exhibit 5-14 odors. For a complete tabulation of responses on odors, see Exhibit C-14.) Food smells and cosmetics are the most common, with body odor, tobacco smoke, new carpets, copy machines, and paint contributing "sometimes" to the problem. Exhibit 5-19 shows the breakdown by Waterside Mall sector for selected odors that have previously been reported anecdotally to be problems.

### **Physical Comfort**

Ergonomic issues encompass lighting, chair comfort, and general workstation comfort. Respondents' overall satisfaction with their physical workstations last year ranges from 62 percent in Waterside to 79 percent in Fairchild (see Exhibit 5-20). For the majority of respondents, the situation stayed about the same over the past year (Exhibit C-15). About two-thirds of employees were reasonably comfortable with their chairs, desk set-up, and equipment (Exhibit C-16); 45 percent to 56 percent reported glare at their workstation (Exhibit C-17). Just over half of respondents rated the lighting at their workstation just right, with about a third finding it a little too dim (Exhibit C-18).

## **5.4 Employee Characteristics**

This section outlines the findings of the survey in terms of background characteristics of respondents, including demographic characteristics, health factors not related to the buildings, job satisfaction and sources of stress, and the physical work environments in which employees work. Information is presented for the three buildings as a whole with no breakdowns for individual Waterside Mall sectors.

Exhibit 5-18a: Odors Noticed at Present Workstation Last Year – WATERSIDE MALL

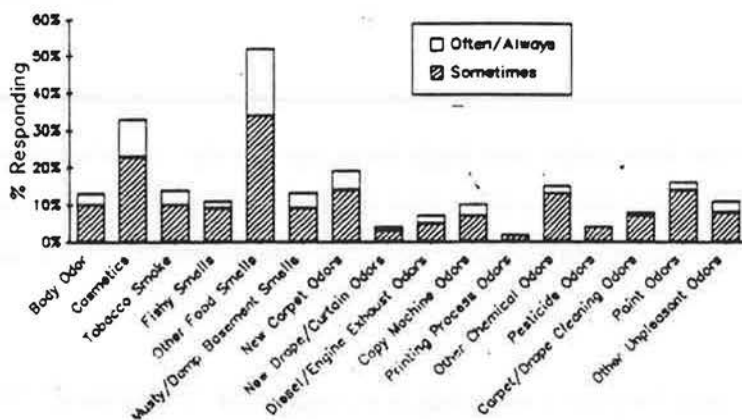


Exhibit 5-18b: Odors Noticed at Present Workstation Last Year – CRYSTAL MALL

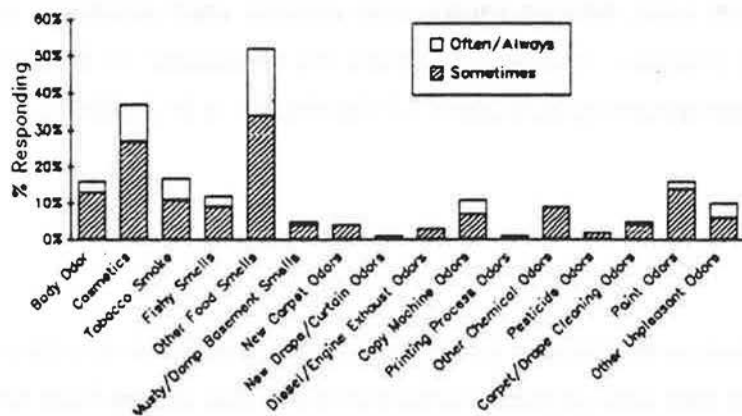
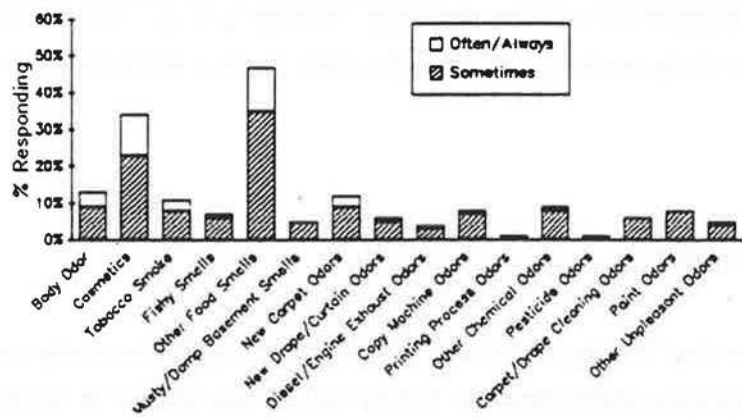
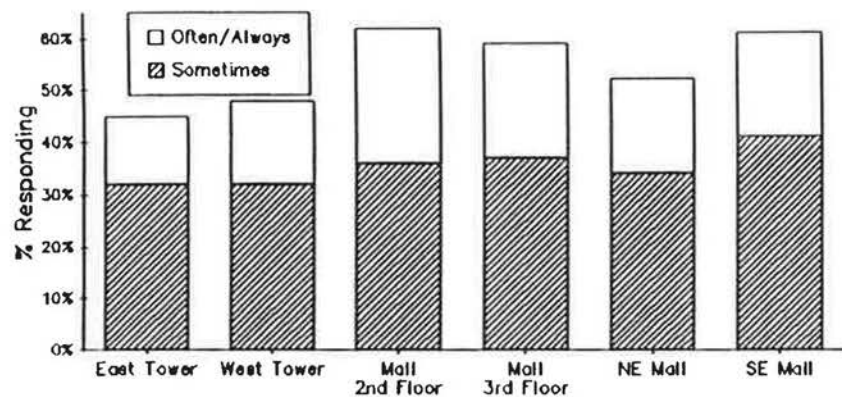


Exhibit 5-18c: Odors Noticed at Present Workstation Last Year – FAIRCHILD BUILDING

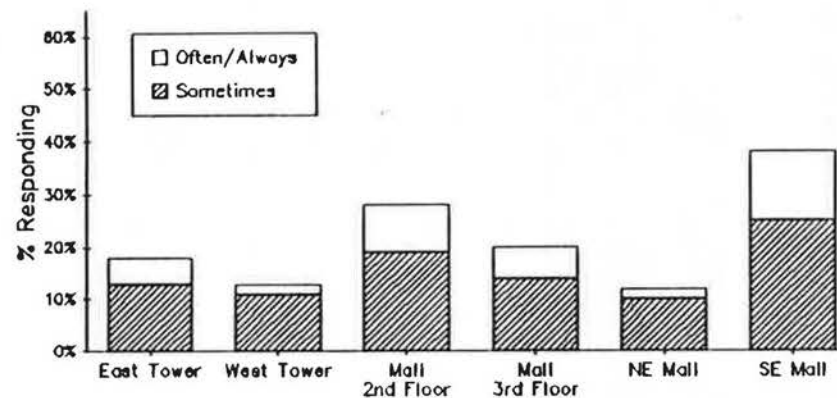


Reference: Part III, Question 2.

**Exhibit 5-19a: Percent of Responding Employees Who Noticed Other\* Food Smells at Present Workstation Last Year, by Waterside Mall Sector**

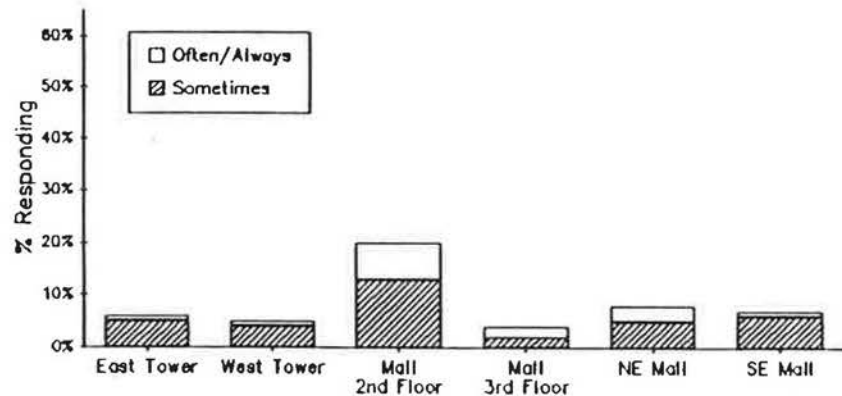


**Exhibit 5-19b: Percent of Responding Employees Who Noticed New Carpet Odors at Present Workstation Last Year, by Waterside Mall Sector**

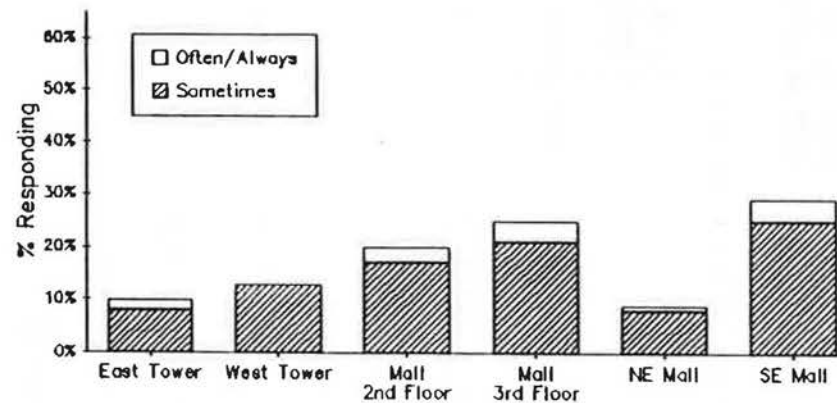


5-32

**Exhibit 5-19c: Percent of Responding Employees Who Noticed Diesel/Engine Exhaust Odors at Present Workstation Last Year, by Waterside Mall Sector**



**Exhibit 5-19d: Percent of Responding Employees Who Noticed Paint Odors at Present Workstation Last Year, by Waterside Mall Sector**



**Exhibit 5-20: Degree of Satisfaction with Physical Workstation Environment Last Year and Last Week, by EPA Headquarters Building**

	EMPLOYEES RESPONDING	PERCENT RESPONDING			
		VERY SATISFIED	SOMEWHAT SATISFIED	NOT TOO SATISFIED	NOT AT ALL SATISFIED
<b>Last Year</b>					
Waterside Mall	3,030	13%	49%	28%	10%
Crystal Mall	448	18%	55%	20%	7%
Fairchild	400	26%	53%	16%	5%
<b>Last Week</b>					
Waterside Mall	3,054	10%	47%	32%	11%
Crystal Mall	450	18%	50%	24%	8%
Fairchild	405	23%	53%	19%	5%

Reference: Part III, Questions 10 and 11.

The factors described in this section will be used in Volume III to help explain patterns of health symptoms and comfort problems. They are expected to provide more detailed insights into the differential health and comfort problems experienced by different types of employees or employees in different buildings or sectors. For example, it may be possible to draw conclusions that certain symptoms are found disproportionately among employees working in particular types of workstations or subject to particular types of work-related stress. Or, for example, people with pre-dispositions to allergies, or people who smoke may experience heightened reactions to indoor air irritants; they may also experience health symptoms independent of the effects of potential indoor air pollution in EPA buildings. It is important to control for these background factors when conducting multivariate analyses, in order to determine to what extent health and comfort symptoms can be attributed to building conditions and to what extent they can be attributed to other independent factors.

#### **5.4.1 Demographics**

The demographic background factors included in the questionnaire involved respondents' age, gender, educational status, and professional status.

Age and gender distributions are shown in Exhibit 5-21. Waterside Mall has a greater percentage of female employees (53%) than the other two buildings (42% at Crystal, 47% at Fairchild). Crystal Mall employees tend to be older than the other two buildings; only 17 percent of Crystal employees are under age 35, compared to about a third at the other two buildings.

Most EPA respondents fall into job categories of managerial, professional, or administrative labor. Fairchild and Waterside employees have somewhat higher proportions of clerical staff (21-22%) than at Crystal Mall (16%) (see Exhibit C-19). Fairchild has considerably fewer people with graduate degrees (27% compared to 45% at Waterside and 54% at Crystal; see Exhibit C-20).



**Exhibit 5-21: Age and Gender Distribution, by EPA Headquarters Building**

	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Male	Female	Male	Female	Male	Female
<b>Employees Responding</b>	1,422	1,597	252	183	209	188
24 years or younger	1%	11%	2%	8%	1%	4%
25 - 34 years	21%	31%	10%	15%	26%	32%
35 - 44 years	42%	36%	39%	44%	47%	36%
45 - 54 years	25%	12%	27%	20%	16%	14%
55 - 64 years	9%	7%	18%	11%	7%	5%
65 years and older	2%	2%	5%	2%	2%	4%

Reference: Part II, Questions 21 and 22.

#### 5.4.2 General Health Characteristics

Several questions on general health characteristics were asked to assess factors which can affect responses to the questions regarding health symptoms. These included medical history, the use of corrective lenses, and smoking history.

- **Medical History** (Exhibits C-21 and C-22). Some individuals have an increased rate of eczema and allergies to pollens or animals. Fewer than 10 percent of respondents in each building reported having had eczema, but between 44 percent and 50 percent of respondents reported an allergy to either pollen, plants, or dust. About 30 percent of respondents in each building indicated they believed they had a special sensitivity to eye, nose, throat, or respiratory irritants. Persons with asthma may report more respiratory symptoms than those without such a condition. Most (82-89%) of the people reporting physician-diagnosed asthma stated that it was diagnosed before they started work in the building. Such pre-existing asthma can thus be a risk factor for the development of symptoms in the building. Individuals who have developed asthma since working in the building may also be at increased risk for other symptoms.
- **Corrective Lenses.** Approximately two-thirds (62-69%) of employees in each building who wear contact lenses, wear them often or always at work (see Exhibit C-23). At Crystal Mall, 20 percent of employees who wear contact lenses never wear them at work. Reasons reported for this included the comment that the air in the building is too dry to wear them comfortably, as well as a number of non-work-related reasons.
- **Tobacco Smoking.** Between 14 and 18 percent of respondents are current smokers; another 22 percent to 31 percent are former smokers (see Exhibit C-24). Among current smokers, the vast majority (85-93%) do not smoke at their workstation, but most smokers (74-89%) sometimes or often do smoke at other locations at work. Few differences were noted between the buildings on smoking habits, although Fairchild shows a slightly higher percentage of smokers, a higher percentage of smoking at work, and higher numbers of cigarettes smoked per day. (All three buildings have policies that permit smoking only in designated rest rooms.)

#### 5.4.3 Job Satisfaction and Stress

Various types of stress are capable of producing health symptoms that are similar to those associated with poor indoor air quality and that may therefore influence the results. A series of questions was designed to assess levels of job satisfaction and sources of work-related and external stress. A description of the distribution of these factors is presented below. Analysis of

the relationships between these stressors and reported health and comfort concerns will be addressed in Volume III.

Responses to questions about job satisfaction were highly similar at all three buildings, as can be seen in Exhibit 5-22: about 85 percent of respondents are very or somewhat satisfied with their jobs. This level of satisfaction drops with respect to salary, but a still substantial majority -- 71-73 percent of respondents -- report that they are satisfied with their salary. Between 57 percent and 65 percent of respondents report being satisfied with the opportunities available for advancement.

Tabulated responses to questions on five job stress scales -- role conflict, job control, quantitative workload, underutilization of abilities, and role ambiguity -- show few differences across EPA buildings (see Exhibits C-25 through C-29). For example, 73 percent to 77 percent of respondents are clear on their job responsibilities, and 59-60 percent indicate that they rarely get conflicting orders from those in a position of authority. On the other hand, many more respondents appear to feel that their skills are being underutilized. For example, only 43 percent to 48 percent of respondents report that they are "fairly often" or "very often" allowed to do the things they do best.

Home and other outside responsibilities can also contribute to stress. Exhibit C-30 contains data on external causes of stress. The distributions are again similar across buildings, with 45-47 percent of employees having children at home, 25-26 percent having major responsibility for child care duties, and 62-66 percent reporting major responsibility for housecleaning duties. Between 29 percent and 34 percent of respondents in each building report a regular commitment of five or more hours per week outside of their jobs.

#### **5.4.4 Workstation and Exposure**

Information on the physical elements of the work environment comes from answers to Part I of the questionnaire.

- **Type of Office Space.** Exhibit 5-23 displays data on types of workstations at EPA headquarters. By far the most common type of working arrangement at Crystal Mall is an enclosed office with a door (84% of respondents), and

**Exhibit 5-22: Satisfaction with Specific Characteristics of Job, by EPA Headquarters Building**

	EMPLOYEES RESPONDING	PERCENT RESPONDING			
		VERY SATISFIED	SOMEWHAT SATISFIED	NOT TOO SATISFIED	NOT AT ALL SATISFIED
<b>Satisfaction with Job</b>					
Waterside Mall	3,042	38%	47%	11%	3%
Crystal Mall	448	38%	46%	13%	3%
Fairchild	400	39%	45%	12%	5%
<b>Satisfaction with Salary</b>					
Waterside Mall	3,039	21%	52%	19%	8%
Crystal Mall	448	21%	50%	22%	8%
Fairchild	399	21%	52%	19%	9%
<b>Satisfaction with Opportunity for Advancement</b>					
Waterside Mall	3,009	22%	39%	24%	16%
Crystal Mall	448	21%	36%	25%	17%
Fairchild	397	23%	42%	22%	13%

Reference: Part IV, Questions 1a, 2 and 3.

**Exhibit 5-23: Description of Current Workstation, by EPA Headquarters Building**

WORKSTATION CHARACTER	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
	Percent Respondents	Percent Respondents	Percent Respondents
<b>Type of Space:</b>			
Enclosed Office with Door	66%	84%	27%
Cubicle with Mid-Height Partitions	19%	7%	65%
Open Office Area	13%	8%	5%
Other	2%	1%	3%
Employees Responding	3,048	444	407
<b>Space Sharing:</b>			
Single Occupant	54%	30%	74%
Shared with One Other Person	26%	51%	19%
Shared with Two or More Other Persons	19%	18%	7%
Employees Responding	3,050	443	405

Reference: Part I, Questions 1a and 1b.

occupancy by either one or two people (81% respondents). At Waterside, 66 percent of respondents' workstations are fully enclosed offices; another 19 percent are cubicles with mid-height partitions, and 13 percent are open office areas. Over half the respondents indicated their workspace has a single occupant. At Fairchild, cubicles are the most commonly found work space (65% of respondents), followed by enclosed offices (27%); 74 percent of respondents have single occupant office space. Fewer than 40 percent of Waterside respondents have a window at their workstation; approximately 65 percent of respondents at the other two buildings have windows (see Exhibit C-31).

- **Workstation furnishings, equipment and recent changes.** Types of furniture and equipment, and recent changes in office surroundings are reported in Exhibit C-32. With respect to new furnishings, Crystal respondents reported less new carpeting, new furniture, and new equipment than did respondents in the other two buildings. More Waterside employees (15%) reported seeing evidence of water leaks than either Crystal (7%) or Fairchild (9%) employees. New carpet and its installation has been a focus of other indoor air quality studies and concern at Waterside Mall. Twenty percent of Waterside respondents, 8 percent of Crystal respondents, and 15 percent of Fairchild respondents indicated that there was new carpet within 15 feet of their workstations.
- **Fans, Heaters, Lamps.** Information on the number of respondents who regularly use portable fans, air filters, heaters, and desk lamps gives a good indication of the degree to which employees are dissatisfied enough with their work environments to take steps to ameliorate the conditions (see Exhibit C-33). Desk lamps were used regularly by 42-46 percent of respondents. Portable fans were used most at Waterside (48% of respondents) and Crystal (45%), and less so at Fairchild (36%). Only Waterside respondents regularly made use of portable heaters in any significant numbers (22% of respondents).
- **Workstation and Computers.** An important element in evaluating indoor air quality and work environment conditions is the notion of exposure -- for example, for how many hours in a typical workday is an employee in the vicinity of particular machines, chemical processes, or other potential pollution sources. Descriptive statistics for some of these important situations are shown in Exhibit C-34. Although on average, respondents had been with EPA between 7 and 11 years, the average number of years at a respondent's current workstation varied from 2.0 years at Fairchild to 3.1 years at Crystal.

Respondents in each building reported spending close to 7 hours per day at their workstations. No large differences were noted between the buildings with respect to the mean amount of time employees spent working with computers (2.9 to 3.5 hours) and copying machines (1 hour). As one would expect, exposure to computers is highly variable across respondents; some respondents rarely if ever use computers, while high-use respondents (such as clerical employees) use them 7-8 hours per day. Most employees did not work in the vicinity of photographic or printing processing or other chemicals such as glues and cleansers; however, some employees did spend most of their day with these processes or exposed to chemicals.

## 5.5 Essay Question

The final question on the questionnaire asked respondents to volunteer their comments on environmental or health matters in their building, using their own words. At Waterside Mall, nearly 1200 persons (about 39%) took the opportunity to write out a response. The response level was similar at Crystal (36%), and lower at Fairchild (26%). Considering that the question came at the end of a long and complex questionnaire, this is evidence that a large number of employees (more than 1,400) still felt they had something to say.

The essay responses cannot, however, be considered as representative of the entire employee population of the buildings. Nor is it possible to assume that the responses necessarily represent the topics about which the respondent feels most strongly, since some topics not mentioned in the response may have been covered adequately in the main questionnaire. Therefore, the essay responses should be considered on their own merits, as anecdotal accounts and suggestions offered by a substantial subgroup of building occupants.

Exhibit 5-24 presents a tabulation of the first condition mentioned in each essay response. These responses may not reflect the primary concerns of the respondents, for two reasons: (a) the primary concerns may have been adequately dealt with in the main questionnaire; and (b) respondents may not necessarily have prioritized their concerns. However, complete tabulations were made on a sample of 100 respondents and the relative frequency of appearance of these conditions was not appreciably changed. Note that the table is incomplete in that it deals with only one condition per respondent; the true number of persons mentioning a given condition is likely to be larger than the number shown.

The responses show marked differences between buildings in terms of concerns mentioned first. Each building had a different pair of first-mentioned concerns:

- At Waterside Mall, top concerns were the maintenance of the building and the health of the respondent, each mentioned by about 20 percent of the respondents.
- The overriding concern at Crystal Mall was air circulation (33% mentioned stuffy, stale air first); followed by overcrowding (14%).

Exhibit 5-24: Summary of Responses to the Essay Question\*

CONDITION	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Maintenance	233	20%	14	8%	5	5%
Health	221	19%	11	7%	10	10%
Air Circulation	190	16%	54	33%	14	13%
Temperature/humidity	172	15%	17	10%	20	19%
Smoking	58	5%	14	8%	20	19%
Overcrowding	57	5%	23	14%	6	6%
Lighting/windows	49	4%	3	2%	4	4%
Odors	40	3%	3	2%	4	4%
Noise	34	3%	4	2%	2	2%
Miscellaneous	106	9%	23	14%	19	18%
Total	1,160	100%**	166	100%	104	100%
Percent of All Respondents	39%		36%		26%	

\*For those who listed several responses to this question, only the first one mentioned is tabulated.

\*\*Does not add to 100% because of rounding.

Reference: Part V, Question 6.



- At Fairchild, tobacco smoke, both in the rest rooms and at people's desks (in violation of EPA's smoking policy) and temperatures (almost always too hot) were both first-mentioned concerns of 19 percent of the essay responses.<sup>6</sup>

### **Employee Reactions to Environmental Factors**

Reactions expressed in the essay responses are summarized below for the following environmental concerns: comfort, tobacco smoke, building maintenance, and overcrowding.

**Comfort.** Comfort variables include ventilation, temperature, and humidity. The most common concern regarding ventilation was of "stuffy" air or no air movement. This was a more common response at Crystal than at the other two buildings. Several respondents identified the need for security and the resultant "sealing" of areas of the building by a series of closed doors as a possible reason for poor air circulation. Several respondents mentioned stale air as reducing their capacity to work. Some respondents in both Fairchild and Crystal reported having to get up and walk to other areas of the building or outside to obtain enough fresh air to be able to continue working.

A common complaint in all buildings was that the temperature was too hot. Many respondents referred to temperatures in the 80's. By contrast, comments that the temperature was sometimes too cold were recorded only by respondents from Waterside. One referred to wearing a winter coat while working at his or her desk throughout the day. Waterside was also the only building where respondents mentioned oscillating hot or cold temperatures as a problem.

Dry air in winter was the most common complaint regarding humidity. Respondents attributed nose dryness and stuffiness to the dry air.

**Building Maintenance.** Comments regarding building maintenance were common at Waterside, less so at the other two buildings. Several respondents said that Waterside Mall was the worst place they had ever worked, citing the lack of maintenance, unpleasant working

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<sup>6</sup>It is worth noting that of the six concerns mentioned first, three – building maintenance, overcrowding, and smoking policy – were not fully explored in the main questionnaire. Future questionnaires of this sort should include questions on employees' perceptions of building maintenance, adequacy of space, and adherence to smoking policy, if any.

conditions, drab, dirty environment, narrow hallways, and maze-like corridors. While a number of respondents directed their anger at EPA management, others pinpointed the design of the building as the principal reason for the intractability of the problem.

In addition to general comments, there were specific concerns expressed about the ventilation system. Waterside respondents referred to dirt-filled air blowing around, sooty, powdery dust, black particles falling from ventilators, and other strange material coming from the ventilation system.

Comments about dusty, dirty working conditions were recorded at all three buildings, with lack of vacuuming, and general clutter contributing to the problem. Poor maintenance of the rest rooms was also mentioned frequently, particularly at Waterside Mall: stopped-up sinks, overflowing toilets, clogged drains, and corresponding dirt, odors, and vermin were mentioned. Remarks on the presence of mice and roaches were more common at Waterside.

**Smoking.** Despite the institution of smoking regulations at EPA, a number of comments at all three buildings had to do with continued smoking. Fairchild respondents, however, appeared particularly concerned about smoking problems, particularly in the rest rooms.

**Overcrowding.** A common concern, particularly in Crystal Mall, was crowded conditions. Some respondents mentioned being unable to concentrate because of overcrowding. In some cases, the overcrowding was due to too many people in too small an office; in other cases, office equipment, furniture, and storage files were mentioned as primary contributors.

### **Employee Reactions to Health Symptoms**

Nearly 200 respondents from Waterside Mall, (compared to only 10-11 from the other two buildings) discussed their health concerns in the essay question. Exhibit 5-25 summarizes the symptoms reported first by essay respondents.

Many EPA respondents used the essay question to report an increased frequency of illness. In addition, respondents reported a complex of symptoms involving two or more bodily systems. Commonly, three or more concurrent symptoms were reported from the following list:

**Exhibit 5-25: Health Symptoms Reported First, by EPA Headquarters Building\***

CONDITION	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Allergies/Reactions	39	18%	0	0%	0	0%
Sinus/Hoarseness	38	17%	1	9%	1	10%
Flu, Colds, Bronchitis	26	12%	5	45%	3	30%
Headache	24	11%	2	18%	1	10%
Sore, Burning Eyes	24	11%	0	0%	0	0%
Fatigue, Drowsiness	12	5%	2	18%	1	10%
Dizziness	7	3%	0	0%	0	0%
Memory Loss	6	3%	0	0%	0	0%
Increased Frequency of Illness	6	3%	0	0%	1	10%
Gynecological Problems	4	2%	0	0%	0	0%
Chest Tightness, Shortness of Breath	3	1%	0	0%	0	0%
Other	32	14%	1	9%	3	30%
<b>Total</b>	<b>221</b>	<b>100%</b>	<b>11</b>	<b>100%**</b>	<b>10</b>	<b>100%</b>

\* For those who listed several responses to this question, only first one mentioned is tabulated here.

\*\*Does not add to 100% because of rounding.

Reference Part V, Question 6.

headaches, dry or burning eyes, sore throat, sinus congestion, dry skin, flu-like symptoms, fatigue, loss of memory, difficulty concentrating, and dizziness/light-headedness. Many respondents associated their symptoms with working in their building.

**Reactions and Allergies.** Many respondents reported chronic or recurring symptoms that they related to allergic reactions to biological contaminants (e.g., dust, mold, pollen, dust mites, roaches), cigarette smoke, marking pens, pesticides, paper (>1 year old), paint, new upholstery, foam products, perfume, hairsprays, and hand lotions. The types of symptoms reported varied from hay fever, sinus congestion, and asthma attacks to fatigue and swollen lymph nodes. In addition, many employees reported acute reactions (e.g., headaches, dizziness, burning eyes) to specific renovation activities, particularly the installation of carpets or moving into offices with new carpets or partitions.

**Respiratory Symptoms.** Many respondents mentioned frequent colds, flu, bronchitis, and pneumonia episodes, and pointed out that their frequency had increased sharply since working at EPA. Sinus congestion, stuffy nose, and sore throat were among the most common symptoms reported.

### **Suggestions by Respondents**

Many respondents gave thoughtful suggestions for ways to improve the building environment. A particularly common suggestion was advance warning before initiating building renovations or spraying chemicals. Other suggestions included more access to natural light in the new building, "full spectrum" lighting, meeting the ASHRAE ventilation standard, central file systems to reduce crowding and exposure to paper, raising partitions off the floor to improve air movement, and wider hallways.

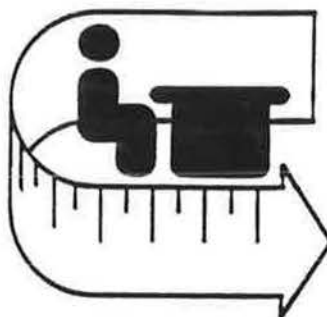
**Employee Questionnaire**

**Appendix A**



# INDOOR AIR QUALITY AND WORK ENVIRONMENT SURVEY

EPA HEADQUARTERS



We are investigating the air quality and work environment in this building. We need information about your work environment and how it affects you. This information is not available anywhere else. Therefore, we must rely on your answers to this survey, along with monitoring of environmental conditions in this building, to clearly analyze the situation. We need your participation, regardless of how satisfied you are with the air quality or your work environment.

Attach Label Here

DO NOT PUT YOUR NAME ON YOUR QUESTIONNAIRE OR THE RETURN ENVELOPE PROVIDED. PLEASE PUT YOUR COMPLETED QUESTIONNAIRE IN THE RETURN ENVELOPE. SEAL IT AND TAKE IT TO ONE OF THE RETURN BOXES NEAR THE ELEVATORS AND BUILDING EXITS.

## **PLEASE READ BEFORE COMPLETING QUESTIONNAIRE**

Many questions in the questionnaire concern either last week or last year. By "LAST YEAR" we mean the 12-month period ending today. If you have worked in the building for less than one year, answer the "LAST YEAR" questions only for the part of the year that you worked in this building.

Please report your ACTUAL EXPERIENCES LAST WEEK even if last week was unusual for you. By "LAST WEEK" we mean any or all days worked from last Monday through Friday.

## **CONFIDENTIALITY**

To protect your privacy, the identification for your questionnaire is the bar-code label on the cover. The bar-code cannot be read by EPA computers or staff. Additionally, the survey forms will be gathered by staff from Westat, Inc., an independent survey research firm, and processed away from EPA. Your name and other information necessary for the survey and analysis that might identify you, such as your room and telephone number, will not be disclosed to individuals, unions, or management of EPA. Reports of the survey will not give your name, nor will data be presented in such a way that you, or anyone else, could be identified.

## **STUDY SPONSORS AND ORGANIZATION**

The study has been developed and is being conducted by the National Institute for Occupational Safety and Health (NIOSH), the John B. Pierce Foundation Laboratory at Yale University, and Westat, Inc. It is being managed by EPA and NIOSH, and is being supported by funds from EPA.



## PART I. DESCRIPTION OF YOUR WORKSTATION

This section asks you to describe your workstation. Your answers to these questions will help us to construct a picture of your work surroundings.

By **WORKSTATION** we mean your desk, office, cubicle, or place that is your primary work area. This description is obvious for many people, but more difficult for those whose jobs require them to move about the building. If you do move about the building, your workstation is the specific location where you spend more time than any other single location. If your workstation has been relocated, use the location where you are now.

1. There are many different types of workstations. Please check the categories that best describe the space in which your current workstation is located.

a. Type of space (Check one)

1.  Enclosed office with door
2.  Cubicle with floor to ceiling bookcases or partitions and no door
3.  Cubicle surrounded by mid-height bookcases or partitions
4.  Open office area
5.  Stacks (e.g., books or periodicals)
6.  Loading dock, laboratory, copy center, or print shops
7.  Work all around the building
8.  Other (specify) \_\_\_\_\_  
\_\_\_\_\_

b. Type of space sharing (Check one)

1.  Single occupant
2.  Shared with one other person
3.  Shared with two or more other persons
4.  Other (describe) \_\_\_\_\_  
\_\_\_\_\_

2. How many years of service do you have with EPA? (Enter number of months if less than one year.)

\_\_\_\_\_ years      \_\_\_\_\_ months

3. a. How many years have you been working in this building? (Enter number of months if less than one year.)

\_\_\_\_\_ years      \_\_\_\_\_ months

- b. During a typical week, how many hours do you spend in this building?

\_\_\_\_\_ hours per week

4. a. How many years have you worked at your current workstation? (Enter number of months if less than one year.)

\_\_\_\_\_ years      \_\_\_\_\_ months

- b. During an average workday, how many hours do you spend at your workstation?

\_\_\_\_\_ hours per day

5. How many days did you work in this building last week?

\_\_\_\_\_ days last week

6. What time do you usually:

		AM	PM
a. Arrive at work	____:____	<input type="checkbox"/>	<input type="checkbox"/>
b. Leave work	____:____	<input type="checkbox"/>	<input type="checkbox"/>
c. Varies (describe)	_____		
	_____		

7. Which of the following items are presently located within 15 feet of your workstation? (Check "no" or "yes" for each item.)

	No	Yes
	1	2
a. Metal desk .....	<input type="checkbox"/>	<input type="checkbox"/>
b. Wood or composition desk ..	<input type="checkbox"/>	<input type="checkbox"/>
c. Metal bookshelves or bookcases .....	<input type="checkbox"/>	<input type="checkbox"/>
d. Wood or composition bookshelves or bookcases ..	<input type="checkbox"/>	<input type="checkbox"/>
e. File cabinet(s) .....	<input type="checkbox"/>	<input type="checkbox"/>
f. Other metal furniture .....	<input type="checkbox"/>	<input type="checkbox"/>
g. Other wood or composition furniture .....	<input type="checkbox"/>	<input type="checkbox"/>
h. Fabric-covered partitions ...	<input type="checkbox"/>	<input type="checkbox"/>
i. Portable humidifier .....	<input type="checkbox"/>	<input type="checkbox"/>
j. Laser printer .....	<input type="checkbox"/>	<input type="checkbox"/>
k. Photocopy machine .....	<input type="checkbox"/>	<input type="checkbox"/>
l. Live plants .....	<input type="checkbox"/>	<input type="checkbox"/>

8. Is there carpeting on most or all of the floor at your workstation?

1.  No  
 2.  Yes

9. During a typical day LAST WEEK, how much time did you spend working with each of the following items? (If you worked with an item at all, but less than 1 hour, enter 1 hour per day.)

	Hours per day
a. Computer or word processor with screen/keyboard .....	_____
b. Photocopy machine .....	_____
c. Photographic developing and processing .....	_____
d. Printing processing (press, binding materials, etc.) .....	_____
e. Other chemicals such as glues, adhesives, cleansers, white out, rubber cement, pesticides, etc. ....	_____

NOTE: If you have worked in this building for less than a year, answer the following questions for the part of the year that you worked in this building.

10. Were any of the following items regularly used at your workstation during the LAST YEAR: (Check "no" or "yes" for each item.)

	No	Yes
	1	2
a. Portable fan .....	<input type="checkbox"/>	<input type="checkbox"/>
b. Portable air filter, or cleaner, or negative-ion generator ....	<input type="checkbox"/>	<input type="checkbox"/>
c. Portable heater .....	<input type="checkbox"/>	<input type="checkbox"/>
d. Desk lamp .....	<input type="checkbox"/>	<input type="checkbox"/>

11. During the LAST YEAR (and since you've been in your current workstation) have any of the following changes taken place within 15 feet of your current workstation? (Check "no" or "yes" for each item.)

	No	Yes
	1	2
a. New carpeting .....	<input type="checkbox"/>	<input type="checkbox"/>
b. New drapes or curtains .....	<input type="checkbox"/>	<input type="checkbox"/>
c. New furniture .....	<input type="checkbox"/>	<input type="checkbox"/>
d. New equipment, such as a computer .....	<input type="checkbox"/>	<input type="checkbox"/>
e. Walls painted .....	<input type="checkbox"/>	<input type="checkbox"/>
f. Rearranged walls .....	<input type="checkbox"/>	<input type="checkbox"/>

12. At any time during the LAST YEAR, have you noticed evidence of new or continuing water leaks from the ceiling, floors, walls, or pipes near your workstation?

- 1.  No
- 2.  Yes

## PART II. INFORMATION ABOUT YOUR HEALTH AND WELL-BEING

This section asks questions about the status of your health and well-being. Your answers to these questions will help us construct a profile of the health status of the employees in this building. Please answer all the questions even if you don't associate these health conditions with your work.

1. a. Do you wear contact lenses?
- Never → Go to Q.2
  - Sometimes
  - Often
  - Always
- b. Do you wear contact lenses at work?
- Never
  - Sometimes → Go to Q.2
  - Often → Go to Q.2
  - Always → Go to Q.2
- c. If never worn at work, why?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
2. During work, how often do you wear eyeglasses (NOT including contacts) for close-up work?
- Never
  - Sometimes
  - Often
  - Always

3. Which of the following best describes your history of smoking tobacco products such as cigarettes, cigars or pipes?
- Never smoked → Go to Q.7
  - Former smoker → Go to Q.7
  - Current smoker
4. Do you smoke tobacco products at your workstation?
- Never
  - Sometimes
  - Often
5. Do you smoke tobacco products elsewhere at work?
- Never
  - Sometimes
  - Often
6. In a typical 24 hour day, how many CIGARETTES do you usually smoke?
- None
  - 1 to 5
  - 6 to 10
  - 11 to 20
  - 21 to 30
  - 31 or more

7. Please answer the three questions to the right about each symptom listed below, even if you believe the symptom is not related to the building.  
 (For each symptom, answer the first question. If the response is "never," go down to the next symptom.)

	Please indicate how often during the LAST YEAR you have experienced this symptom while working in this building.					Please indicate how many days LAST WEEK you experienced this symptom while working in this building. (Fill in No. of days)	Does the symptom usually change when not at work?		
	Never	Rarely	Sometimes	Often	Always		Gets Worse	Stays Same	Gets Better
a. headache .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
b. nausea .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
c. runny nose .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
d. stuffy nose/sinus congestion ...	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
e. sneezing .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
f. cough .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
g. wheezing or whistling in chest ..	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
h. shortness of breath .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
i. chest tightness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
j. dry, itching, or tearing eyes .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
k. sore/strained eyes .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
l. blurry/double vision .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
m. burning eyes .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
n. sore throat .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
o. hoarseness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
p. dry throat .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
q. unusual fatigue or tiredness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
r. sleepiness or drowsiness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

7. (continued)

(For each symptom, answer the first question. If the response is "never," go down to the next symptom.)

	Please indicate how often during the LAST YEAR you have experienced this symptom while working in this building.					Please indicate how many days LAST WEEK you experienced this symptom while working in this building. (Fill in No. of days)	Does the symptom usually change when not at work?		
	Never	Rarely	Sometimes	Often	Always		Gets Worse	Stays Same	Gets Better
a. chills .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
t. fever .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
u. aching muscles or joints .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
v. problems with contact lenses ...	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
w. difficulty remembering things ...	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
x. dizziness/lightheadedness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
y. feeling depressed .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
z. tension or nervousness .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
aa. difficulty concentrating .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
bb. dry or itchy skin .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
cc. pain or stiffness in upper back ..	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
dd. pain or stiffness in lower back ..	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
ee. pain or numbness in shoulder/neck .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
ff. pain or numbness in hands or wrists .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	_____	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

**NOTE:** The next four questions (Questions 8-11) refer to your symptoms described in Question 7. If you reported that you never experienced any of these symptoms, go to Question 12.

8. How often during the LAST YEAR have any of your symptoms reduced your ability to work in this building?

- 1.  Never
- 2.  Rarely
- 3.  Sometimes
- 4.  Often
- 5.  Always

9. a. Have any of your symptoms caused you to stay home from work or leave work early during the LAST YEAR?

- 1.  Never → Go to Q.10
- 2.  Rarely
- 3.  Sometimes
- 4.  Often

b. Which symptoms?

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10. In which season(s) are you bothered more by the symptoms you reported in Question 7? (Check all that apply.)

- 1.  Winter
- 2.  Spring
- 3.  Summer
- 4.  Fall
- 5.  No relation to seasons

11. a. Do you associate any of the symptoms you reported in Question 7 with your work in this building?

- 1.  No → Go to Q.12
- 2.  Yes

b. Have these symptoms:

- 1.  improved over the last year
- 2.  become worse over the last year
- 3.  stayed the same

12. During the LAST YEAR, have you had an illness in which you had repeated episodes of THREE OR MORE of the following symptoms at the same time: wheezing, cough, shortness of breath, fever, chills, aching joints/muscles?

- 1.  No
- 2.  Yes

13. During the LAST YEAR, have you had any chest illnesses, such as bronchitis or pneumonia, that have kept you off work, indoors at home, or in bed?

- 1.  No
- 2.  Yes

14. Has a physician ever told you that you have, or had, eczema?

- 1.  No
- 2.  Yes

15. During the LAST YEAR, have you had any episodes of wheezing (whistling in the chest) WITHOUT fever, or chills, or sore throat?

- 1.  No
- 2.  Yes

16. a. Has a physician ever told you that you have, or had, asthma?

1.  No → Go to Q.17  
 2.  Yes

b. In what year was it first diagnosed?

19 \_\_\_\_\_

c. Have you had an asthma attack during the LAST YEAR?

1.  No  
 2.  Yes

17. Comparing your health since working in this building with your health before you began to work in this building ...

a. ... do you have infections (e.g., colds, flu, bronchitis, etc.) ...

1.  more frequently?  
 2.  less frequently?  
 3.  with the same frequency?

b. ... do your infections (e.g., colds, flu, bronchitis, etc.) tend to ...

1.  last longer?  
 2.  last a shorter amount of time?  
 3.  last about the same amount of time?

18. Do you believe you are or may be allergic to any of the following? (Check "no" or "yes" for each item.)

	No 1	Yes 2
a. pollen or plants .....	<input type="checkbox"/>	<input type="checkbox"/>
b. animals .....	<input type="checkbox"/>	<input type="checkbox"/>
c. dust .....	<input type="checkbox"/>	<input type="checkbox"/>
d. molds .....	<input type="checkbox"/>	<input type="checkbox"/>
e. Other (specify) .....	<input type="checkbox"/>	<input type="checkbox"/>

19. During the LAST YEAR, how often do you believe you have experienced EYE, NOSE, THROAT, OR RESPIRATORY IRRITATION at your workstation from:

	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS
	1	2	3	4	5
a. Tobacco smoke ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Fumes from a photocopying machine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Fumes from printing processing (press, binding materials, etc.) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Fumes from other chemicals such as adhesives, glues, cleansers, white out, rubber cement, etc. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Fumes from pesticides .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Fumes from new carpeting .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Fumes from new drapes, curtains, or furniture .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Fumes from paint .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Fumes from cleaning of carpets, drapes, or other furnishings .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Other (specify) .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



20. Do you consider yourself especially sensitive to any of the items in Question 19?

1.  No
2.  Yes

21. How old are you?

\_\_\_\_\_ years

22. Are you:

1.  Male → Go to Part III on pg. 11
2.  Female

Women working in office buildings have occasionally reported patterns of gynecological or women's health problems. The following questions have been included to help sort out some of these issues in this building.

As with the rest of the questions in this survey, your responses are entirely voluntary and will be kept confidential.

23. During the LAST YEAR have you menstruated (had a period)?

1.  No → Go to Q.29
2.  Yes

24. How often during the LAST YEAR has your period been regular? (By regular, we mean your periods come about once a month, you can usually predict when they will come plus or minus 4 days, and each time they last about the same number of days.)

1.  Never
2.  Rarely
3.  About half the time
4.  Often
5.  Always

25. a. How many days does your menstrual flow (period) typically last?

\_\_\_\_\_ days

b. During the last year, what was the LONGEST period you had?

\_\_\_\_\_ days

c. During the last year, what was the SHORTEST period you had?

\_\_\_\_\_ days

26. a. How many days does your cycle typically last? (Count from the first day of one period to the first day of the next.)

\_\_\_\_\_ days

b. During the last year, what was the LONGEST cycle you had?

\_\_\_\_\_ days

c. During the last year, what was the SHORTEST cycle you had?

\_\_\_\_\_ days

27. How often during the LAST YEAR has there been bleeding or spotting between your periods?

1.  Never
2.  1 - 3 times
3.  4 - 6 times
4.  7 - 9 times
5.  10 or more times

28. a. Some women experience menstrual symptoms, such as headaches, weight gain, irritability, cramping, breast tenderness, or back pain. How often have you experienced any of these menstrual symptoms during the LAST YEAR?

- 1.  Never → Go to Q.29
- 2.  1 - 3 times
- 3.  4 - 6 times
- 4.  7 - 9 times
- 5.  10 or more times

b. When you experience these symptoms, typically how severe are they?

- 1.  Mild; could be ignored at times
- 2.  Moderate; pain, bloating, or mood change noticeably present
- 3.  Severe; difficult to do most tasks
- 4.  Extreme; incapacitating

29. During the LAST YEAR have you been ... (Check "no" or "yes" for each item.)

	No 1	Yes 2
a. Pregnant or nursing? .....	<input type="checkbox"/>	<input type="checkbox"/>
b. Taking birth control pills? ...	<input type="checkbox"/>	<input type="checkbox"/>
c. Going through menopause (change of life)? .....	<input type="checkbox"/>	<input type="checkbox"/>
d. Post-menopausal (completed menopause)? ...	<input type="checkbox"/>	<input type="checkbox"/>
e. Taking estrogen replacement therapy? .....	<input type="checkbox"/>	<input type="checkbox"/>

30. a. During the LAST YEAR have you been taking hormones prescribed by a physician?

- 1.  No → Go to Q.31
- 2.  Yes

b. Specify what kind(s) and what they were prescribed for.

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31. a. Has a physician ever told you that you had ... (Check "no" or "yes" for each item.)

	No 1	Yes 2	Year First Diagnosed
Fibroids? .....	<input type="checkbox"/>	<input type="checkbox"/>	_____
Cysts? .....	<input type="checkbox"/>	<input type="checkbox"/>	_____
Enlarged uterus? .....	<input type="checkbox"/>	<input type="checkbox"/>	_____

→ If all are "no," go to Part III

b. Have there been noticeable changes during the last year? (Check one box for each item.)

	Decreased In Size 1	Increased In Size 2	No Change 3	Other, Specify Below 4
Fibroids ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cysts .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enlarged uterus .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Specify \_\_\_\_\_

---



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## PART III. INFORMATION ABOUT YOUR PRESENT WORK ENVIRONMENT

This section asks you to report specific responses to the physical environment at your present workstation. You or a co-worker may have altered your work environment with a portable fan, heater, humidifier, etc. If so, please tell us how your work environment would have been without this equipment.

1. At your present workstation, **HOW OFTEN . . .**  
*(Please check one box for last year and one box for last week.)*

	. . . during the LAST YEAR					. . . during the LAST WEEK				
	Never	Rarely	Some- times	Often	Always	Never	Rarely	Some- times	Often	Always
a. was there too much air movement? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
b. was there too little air movement? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
c. did you want to adjust the air movement? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
d. was the temperature too hot? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
e. was the temperature too cold? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
f. did you want to adjust the temperature? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
g. was it too humid? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
h. was it too dry? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
i. did you want to adjust the humidity? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
j. was the air too stuffy? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
k. was it too noisy? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
l. was it too quiet? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
m. was the work area too dusty? . . . . .	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>

2. During the LAST YEAR, how often, if at all, have you noticed any of these types of ODORS at your present workstation? (Check one box for each item.)

	ALWAYS				
	OFTEN				
	SOMETIMES				
	RARELY				
	NEVER				
	1	2	3	4	5
a. Body odor .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Cosmetics, such as perfume or after-shave .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Tobacco smoke ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Fishy smells .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Other food smells ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Musty or damp basement smells ..	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Odors from new carpet .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Odors from new drapes or curtains .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Odors from diesel or other engine exhaust .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Odors from a photocopying machine .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. Odors from printing processing (press, binding materials, etc.) ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	ALWAYS				
	OFTEN				
	SOMETIMES				
	RARELY				
	NEVER				
	1	2	3	4	5

2. (continued)

l. Odors from other chemicals such as adhesives, glues, cleansers, white out, rubber cement, pesticides, etc. ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. Odors from pesticides .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. Odors from cleaning of carpets, drapes, or other furnishings .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o. Odors from paint .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
p. Other unpleasant odors (describe) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. In which seasons would you most like to adjust the physical conditions around your workstation? (Check all that apply)

	None	Winter	Spring	Summer	Fall
a. Air movement ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Temperature ....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Humidity .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Odors .....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Please rate the lighting at your workstation.

- 1.  Much too dim
- 2.  A little too dim
- 3.  Just right
- 4.  A little too bright
- 5.  Much too bright

5. a. Do you experience a reflection or "glare" in your field of vision when at your workstation?

- 1.  Never → Go to Q.6
- 2.  Sometimes
- 3.  Often
- 4.  Always

b. Where does the reflection or glare come from? (Check all that apply)

- 1.  Window, sunlight, outside reflection
- 2.  Overhead fluorescent lights
- 3.  Video display screen and/or reflections when looking at screen
- 4.  Desk lamp
- 5.  Other (specify) \_\_\_\_\_

6. Can you see out an outside window from your workstation?

- 1.  No
- 2.  Yes

7. a. How comfortable is the chair at your workstation?

- 1.  Reasonably comfortable
- 2.  Somewhat uncomfortable
- 3.  Very uncomfortable
- 4.  Don't have one specific chair → Go to Q.8

b. Is your chair easily adjustable?

- 1.  No
- 2.  Yes
- 3.  Not adjustable

8. How comfortable is the current set-up of your desk or work table (that is, height and general arrangement of the table, chair, and equipment you work with)?

- 1.  Reasonably comfortable
- 2.  Somewhat uncomfortable
- 3.  Very uncomfortable
- 4.  Don't have one specific desk or work table

9. a. During the LAST YEAR, how many times per week did you go outdoors, weather permitting, during work hours (for lunch, break, or other reasons)?

\_\_\_\_\_ time(s) per week → If zero, go to Q.10

b. How many of these times did you go outdoors primarily to get some fresh air?

\_\_\_\_\_ time(s) per week for fresh air

**NOTE:** The next four questions concern the overall physical environment at your workstation, that is, the air quality, temperature, light, noise, odor, etc.

10. During the LAST WEEK, how satisfied were you with the physical environment at your workstation?

1.  Very satisfied
2.  Somewhat satisfied
3.  Not too satisfied
4.  Not at all satisfied

11. During the LAST YEAR, how satisfied were you with the overall physical environment at your workstation?

1.  Very satisfied
2.  Somewhat satisfied
3.  Not too satisfied
4.  Not at all satisfied

12. During the LAST YEAR, has the overall physical environment in the vicinity of your workstation:

1.  improved
2.  become worse
3.  stayed the same

13. During a typical work day, does the overall physical environment in the vicinity of your workstation:

1.  improve during the day
2.  become worse during the day
3.  stay the same

## PART IV. CHARACTERISTICS OF YOUR JOB

This section asks you to describe your job in terms of specific qualities. In order to gain a better understanding of your work environment, we would like to know how you feel about your job situation. As stated before, your responses will be kept confidential.

1. We would like you to think about the TYPE OF WORK YOU DO IN YOUR JOB. (Check one box for each statement)
  - a. All in all, how satisfied are you with your job?
    1.  Very satisfied
    2.  Somewhat satisfied
    3.  Not too satisfied
    4.  Not at all satisfied
  - b. Knowing what you know now, if you had to decide again whether to take the job you now have, what would you decide? Would you ...
    1.  Decide without hesitation to take the same job
    2.  Have some second thoughts
    3.  Decide definitely not to take the same job
  - c. If you were free right now to go into any type of job you wanted, what would your choice be? Would you ...
    1.  Take the same job
    2.  Take a different job
    3.  Not want to work
  - d. If a friend of yours told you he/she was interested in working in a job like yours, what would you tell him/her? Would you ...
    1.  Strongly recommend it
    2.  Have doubts about recommending it
    3.  Advise against it

2. How satisfied are you with your salary?
  1.  Very satisfied
  2.  Somewhat satisfied
  3.  Not too satisfied
  4.  Not at all satisfied
3. How satisfied are you with your opportunity for advancement at EPA?
  1.  Very satisfied
  2.  Somewhat satisfied
  3.  Not too satisfied
  4.  Not at all satisfied

6. The next series of questions asks HOW OFTEN certain things happen at your job. (Check one box for each question)

	VERY OFTEN				
	FAIRLY OFTEN				
	SOMETIMES				
	OCCASIONALLY				
	RARELY				
a. How often does your job require you to work very fast? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
b. How often does your job require you to work very hard? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
c. How often does your job leave you with little time to get things done? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
d. How often is there a great deal to be done? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
e. How often does your job let you use the skills and knowledge you learned in school? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
f. How often are you given a chance to do the things you do best? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>

	VERY OFTEN				
	FAIRLY OFTEN				
	SOMETIMES				
	OCCASIONALLY				
	RARELY				
6. (Continued)					
g. How often can you use the skills from your previous experience and training? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
h. How often are you clear on what your job responsibilities are? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
i. How often can you predict what others will expect of you on the job? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
j. How much of the time are your work objectives well defined? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
k. How often are you clear about what others expect of you on the job? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>



4. Conflicts can occur in any job. For example, someone may ask you to do work in a way which is different from what you think is best, or you may find that it is difficult to satisfy everyone. HOW OFTEN do you face problems in your work like the ones listed below? (Check one box for each statement)

	VERY OFTEN			
	FAIRLY OFTEN		SOMETIMES	
	RARELY OR NEVER			
a. Persons equal in rank and authority over you ask you to do things which conflict. ....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
b. People in a good position to see if you do what they ask give you things to do which conflict with one another. ....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>
c. People whose requests should be met give you things which conflict with other work you have to do. ....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>

5. The next series of questions asks HOW MUCH influence you now have in each of several areas at work. By influence we mean the degree to which you control what is done by others and have freedom to determine what you do yourself. (Check one box for each question)

	VERY MUCH				
	A MODERATE AMOUNT			MUCH	
	LITTLE				
	VERY LITTLE				
a. How much influence do you have over the amount of work you do? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
b. How much influence do you have over the availability of materials you need to do your work? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
c. How much do you influence the policies and procedures in your work group? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
d. How much influence do you have over the arrangement of furniture and other work equipment at your workstation? .....	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>

7. In order to better understand your responsibilities outside your normal working day, the next series of questions deals with other significant aspects of your life. (Check "no" or "yes" for each question)

- |  | No<br>1                  | Yes<br>2                 |
|--|--------------------------|--------------------------|
| a. Do you have children at home? .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Do you have major responsibility for childcare duties? .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Do you have major responsibility for housecleaning duties? .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Do you have major responsibility for the care of an elderly or disabled person on a regular basis? .....  | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Are you taking courses for credit toward a degree or a diploma? .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Do you have a regular commitment of five hours or more per week, paid or unpaid, outside of this job? (Include volunteer work, charitable work, second job, etc.) ..... | <input type="checkbox"/> | <input type="checkbox"/> |

## PART V. CONCLUDING QUESTIONS

This section concludes this survey. Your answers to these questions, like your answers to the previous questions, will be kept confidential. This information is needed for statistical purposes.

1. What day of the week did you complete this survey?

1.  Monday
2.  Tuesday
3.  Wednesday
4.  Thursday
5.  Friday

2. Which of the following best describes your current living and financial arrangements?

1.  Live alone, sole provider of rent/mortgage, utilities, food, and other living expenses.
2.  Live alone, but receive assistance from one or more others in paying rent/mortgage, utilities, food, and other living expenses.
3.  Live with one or more other persons, but sole provider of rent/mortgage, utilities, food, and other living expenses.
4.  Live with one or more other persons who help to pay rent/mortgage, utilities, food, and other living expenses.

3. What is the highest grade you completed in school?

1.  8th grade or less
2.  9th, 10th, or 11th grade
3.  High school graduate
4.  2 years of college or Associate Degree
5.  Bachelor's or technical degree
6.  Some graduate work
7.  Graduate or professional degree

4. a. What is your pay plan and grade (e.g., GS-5, GM-14, SES-2, WG-2, etc.)?

\_\_\_\_\_

b. Which of the following best describes your job duties and responsibilities? (If more than one applies, check the ONE box for the job duties on which you spend the most time.)

1.  Managerial (such as administrator, manager, etc.)
2.  Professional (such as engineer, scientist, lawyer, etc.)
3.  Technical (such as technician, programmer, etc.)
4.  Administrative Support (such as clerical, computer operator, etc.)
5.  Service (such as health services, food preparation, janitorial, etc.)
6.  Craftsman (such as mechanic, repairer, etc.)
7.  Operator or laborer
8.  Other (specify) \_\_\_\_\_

\_\_\_\_\_

The following information is needed so that your workstation can be located within this building. This is necessary so that we can relate your responses to the air measurements that will be taken in a few weeks. As with the rest of the questions in this survey, this information will be kept confidential. Please tell us:

5. a. Your room number

\_\_\_\_\_

b. Your workstation telephone number (your direct or private number.)

\_\_\_\_\_



**In a few weeks we plan to conduct air measurements in this building. At that time people whose workstations are close to the air measurement locations will be asked a few additional questions. You may be recontacted at that time.**

**Thank you very much for your time and patience in filling out this questionnaire.**

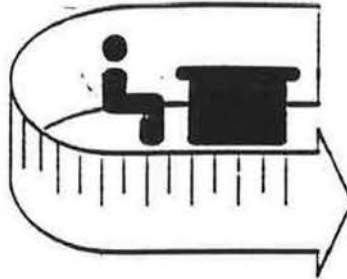


**Appendix B**

**Supplemental Questionnaire**







## INDOOR AIR QUALITY AND WORK ENVIRONMENT FOLLOWUP SURVEY

### EPA HEADQUARTERS

Measurements of a variety of environmental conditions are being taken in your work area throughout the day TODAY. To help determine how these measurements relate to your comfort and health, please complete the attached questionnaire. Your participation in this part of the evaluation of this building is, of course, voluntary.

Your completed questionnaire will be collected by and analyzed by Westat and Yale investigators and WILL NOT BE SEEN BY EPA MANAGEMENT OR UNION REPRESENTATIVES.

So that we may combine your responses to this questionnaire with the questionnaire distributed three weeks ago, we need you to print your name below. As soon as we have matched your questionnaires, we will remove this cover sheet and save this questionnaire without your name on it. At that time, we will also remove your name from the final combined data file.

YOUR FULL NAME:

*(please print)*

\_\_\_\_\_ FIRST

\_\_\_\_\_ MIDDLE

\_\_\_\_\_ LAST

Please complete this questionnaire even if you did not complete the questionnaire distributed previously.

After you complete this questionnaire, please place it in the attached envelope and seal it. A study investigator will collect it from you.

THANK YOU FOR YOUR PARTICIPATION IN THIS SURVEY.



Date: \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_

Cart No.: \_\_\_\_\_

Location: \_\_\_\_\_

(To be completed by investigators)

## INDOOR AIR QUALITY AND WORK ENVIRONMENT STUDY

I. Your answers to the following questions will allow a better interpretation of the environmental measurements taken TODAY in the area around your workstation.

1. Did you complete and return the yellow-covered Indoor Air Quality and Work Environment questionnaire distributed during the weeks of February 13 and 21, 1989?

1.  No  
2.  Yes

2. Have you been in this building at least 4 hours yet TODAY?

1.  No  
2.  Yes

3. How many hours (to the nearest 1/2 hour) have you spent at your workstation TODAY? (Enter 0 if you have not been at your workstation today.)

\_\_\_\_\_ hours this morning (before 12:00 noon)

\_\_\_\_\_ hours this afternoon (between 12:00 noon and time you complete this questionnaire)

4. Since you arrived at work TODAY, have you gone outside (for lunch, break, or other reason)?

1.  No  
2.  Yes

5. How many hours (to the nearest 1/2 hour) have you spent TODAY working at a photo-copy machine?

\_\_\_\_\_ hours

6. How many hours (to the nearest 1/2 hour) have you spent TODAY working at a video display terminal?

\_\_\_\_\_ hours

7. During the day TODAY, have you or anyone else performed any of the following activities at or near your workstation? (Check "no" or "yes" for each item.)

	No	Yes
	1	2
a. Smoked tobacco .....	<input type="checkbox"/>	<input type="checkbox"/>
b. Used a humidifier .....	<input type="checkbox"/>	<input type="checkbox"/>
c. Used a cleanser, glue, white out, or other strong-smelling chemical .....	<input type="checkbox"/>	<input type="checkbox"/>
d. Used a computer or word processor .....	<input type="checkbox"/>	<input type="checkbox"/>
e. Used a printer .....	<input type="checkbox"/>	<input type="checkbox"/>

11. For the following, please check the response that best describes your work environment TODAY . . .  
 (Please check one box for this morning and one box for this afternoon.)

	This MORNING	This AFTERNOON
1. Has the AIR MOVEMENT been:	1. <input type="checkbox"/> too much 2. <input type="checkbox"/> too little 3. <input type="checkbox"/> just right	1. <input type="checkbox"/> too much 2. <input type="checkbox"/> too little 3. <input type="checkbox"/> just right
2. Has the TEMPERATURE been:	1. <input type="checkbox"/> too hot 2. <input type="checkbox"/> too cold 3. <input type="checkbox"/> just right	1. <input type="checkbox"/> too hot 2. <input type="checkbox"/> too cold 3. <input type="checkbox"/> just right
3. Has the HUMIDITY been:	1. <input type="checkbox"/> too humid 2. <input type="checkbox"/> too dry 3. <input type="checkbox"/> just right	1. <input type="checkbox"/> too humid 2. <input type="checkbox"/> too dry 3. <input type="checkbox"/> just right
4. Has the NOISE LEVEL been:	1. <input type="checkbox"/> too loud 2. <input type="checkbox"/> too quiet 3. <input type="checkbox"/> just right	1. <input type="checkbox"/> too loud 2. <input type="checkbox"/> too quiet 3. <input type="checkbox"/> just right
5. Has the air been TOO STUFFY?	1. <input type="checkbox"/> No 2. <input type="checkbox"/> Yes	1. <input type="checkbox"/> No 2. <input type="checkbox"/> Yes
6. Has your work area been TOO DUSTY?	1. <input type="checkbox"/> No 2. <input type="checkbox"/> Yes	1. <input type="checkbox"/> No 2. <input type="checkbox"/> Yes

7. a. Would you like to adjust any of the above conditions?

1.  No → Go to Q.8

2.  Yes

b. If yes, which condition(s) would you adjust?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. Have you noticed any of these types of ODORS at your workstation TODAY? (Check one box for each item.)

	No	Yes
	1	2
a. Body odor .....	<input type="checkbox"/>	<input type="checkbox"/>
b. Cosmetics, such as perfume or after-shave .....	<input type="checkbox"/>	<input type="checkbox"/>
c. Tobacco smoke .....	<input type="checkbox"/>	<input type="checkbox"/>
d. Fishy smells .....	<input type="checkbox"/>	<input type="checkbox"/>
e. Other food smells .....	<input type="checkbox"/>	<input type="checkbox"/>
f. Musty or damp basement smells .....	<input type="checkbox"/>	<input type="checkbox"/>
g. Odors from new carpet .....	<input type="checkbox"/>	<input type="checkbox"/>
h. Odors from new drapes or curtains .....	<input type="checkbox"/>	<input type="checkbox"/>
i. Odors from diesel or other engine exhaust .....	<input type="checkbox"/>	<input type="checkbox"/>
j. Odors from a photocopier .....	<input type="checkbox"/>	<input type="checkbox"/>
k. Odors from printing processing (press, binding materials, etc.) .....	<input type="checkbox"/>	<input type="checkbox"/>
l. Odors from other chemicals such as adhesives, glues, cleansers, white out, rubber cement, pesticides, etc. ....	<input type="checkbox"/>	<input type="checkbox"/>
m. Odors from pesticides .....	<input type="checkbox"/>	<input type="checkbox"/>
n. Odors from cleaning of carpets, drapes, or other furnishings .....	<input type="checkbox"/>	<input type="checkbox"/>
o. Odors from paint .....	<input type="checkbox"/>	<input type="checkbox"/>
p. Other unpleasant odors (describe) .....	<input type="checkbox"/>	<input type="checkbox"/>

9. How would you judge the overall air quality in this building TODAY?

- 1.  Excellent
- 2.  Good
- 3.  Fair
- 4.  Poor

III. Have you experienced any of the following symptoms while at work in this building TODAY? (For each symptom, answer "no" or "yes." If your response is "no," go down to the next symptom.)

	IF YES, when did this symptom begin?				
	NO	YES	BEFORE ARRIVING AT WORK	THIS MORNING AT WORK	THIS AFTERNOON AT WORK
a. headache .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
b. nausea .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
c. runny nose .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
d. stuffy nose/sinus congestion .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
e. sneezing .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
f. cough .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
g. wheezing or whistling in chest .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
h. shortness of breath .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
i. chest tightness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
j. burning lungs .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
k. dry, itching, or tearing eyes .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
l. sore/strained eyes .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
m. blurry/double vision .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
n. burning eyes .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
o. sore throat .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
p. hoarseness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
q. dry throat .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
r. unusual fatigue or tiredness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
s. sleepiness or drowsiness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
t. chills .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
u. fever .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
v. aching muscles or joints .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
w. problems with contact lenses .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
x. difficulty remembering things .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
y. dizziness/lightheadedness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
z. feeling depressed .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
aa. tension or nervousness .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
bb. difficulty concentrating .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
cc. dry or itchy skin .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
dd. pain or stiffness in upper back .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
ee. pain or stiffness in lower back .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
ff. pain or numbness in shoulder/neck ..	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>
gg. pain or numbness in hands or wrists .	1. <input type="checkbox"/>	2. <input type="checkbox"/>	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>

IV. The quality of indoor air and other working conditions may influence the way a person feels. For each of the following, please indicate how you have been feeling TODAY. (Check one box for each item.)

	Not at all	A little	Moderately	Quite a lot	Extremely
a. worn out .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
b. listless .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
c. lively .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
d. active .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
e. on edge .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
f. shaky .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
g. energetic .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
h. tense .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
i. relaxed .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
j. uneasy .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
k. restless .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
l. fatigued .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
m. nervous .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
n. cheerful .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
o. exhausted .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
p. anxious .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
q. sluggish .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
r. panicky .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
s. weary .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
t. alert .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
u. full of pep .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
v. carefree .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
w. vigorous .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>
x. bushed .....	1. <input type="checkbox"/>	2. <input type="checkbox"/>	3. <input type="checkbox"/>	4. <input type="checkbox"/>	5. <input type="checkbox"/>

V. What time is it now?

\_\_\_\_ : \_\_\_\_ PM

Thank you for your time and patience in filling out this questionnaire. Your answers to this questionnaire, like the previous questionnaire, will be kept confidential.





**Appendix C**

**Selected Data Tables from Employee Survey**



**Exhibit C-1a: Frequency Distribution of Symptoms Reported Last Year -- WATERSIDE MALL**

SYMPTOMS	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS	TOTAL REPORTING
a. Headache	9%	28%	42%	19%	2%	3,082
b. Nausea	53%	32%	13%	2%	0%	3,063
c. Runny Nose	15%	30%	38%	14%	3%	3,062
d. Stuffy Nose	12%	22%	35%	24%	7%	3,067
e. Sneezing	14%	36%	39%	10%	1%	3,064
f. Cough	19%	42%	31%	7%	1%	3,067
g. Wheezing	67%	22%	8%	2%	0%	3,060
h. Shortness of Breath	64%	21%	11%	3%	1%	3,064
i. Chest Tightness	69%	19%	10%	2%	0%	3,059
j. Dry, Itching, or Tearing Eyes	27%	21%	30%	17%	4%	3,068
k. Sore/Strained Eyes	25%	22%	32%	17%	4%	3,062
l. Blurry/Double Vision	61%	19%	13%	5%	1%	3,062
m. Burning Eyes	41%	22%	24%	10%	3%	3,065
n. Sore Throat	25%	39%	28%	7%	1%	3,065
o. Hoarseness	47%	32%	16%	4%	1%	3,065
p. Dry Throat	31%	30%	25%	11%	2%	3,062
q. Unusual Fatigue	22%	24%	33%	17%	4%	3,068
r. Sleepiness	15%	24%	40%	16%	4%	3,065
s. Chills	49%	27%	18%	5%	1%	3,071
t. Fever	54%	36%	9%	1%	0%	3,065
u. Aching Muscles	39%	28%	22%	8%	2%	3,071
v. Problems w/ Contact Lenses*	12%	17%	37%	23%	11%	624
w. Difficulty Remembering Things	47%	23%	23%	5%	1%	3,062
x. Dizziness/Lightheadedness	51%	26%	19%	4%	1%	3,065
y. Feeling Depressed	35%	30%	26%	7%	1%	3,066
z. Tension or Nervousness	27%	26%	34%	11%	2%	3,061
aa. Difficulty Concentrating	30%	28%	32%	9%	1%	3,064
bb. Dry or Itchy Skin	34%	18%	25%	16%	7%	3,061
cc. Pain in Upper Back	47%	21%	21%	9%	2%	3,065
dd. Pain in Lower Back	39%	23%	26%	10%	3%	3,062
ee. Pain in Shoulder/Neck	52%	19%	18%	9%	2%	3,063
ff. Pain in Hands or Wrist	67%	17%	11%	4%	1%	3,062

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.



**Exhibit C-1b: Frequency Distribution of Symptoms Reported Last Year -- CRYSTAL MALL**

SYMPTOMS	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS	TOTAL REPORTING
a. Headache	16%	30%	37%	15%	1%	447
b. Nausea	55%	31%	12%	2%	0%	441
c. Runny Nose	16%	32%	35%	13%	3%	445
d. Stuffy Nose	16%	22%	32%	23%	7%	447
e. Sneezing	15%	37%	38%	9%	1%	446
f. Cough	21%	41%	30%	7%	1%	446
g. Wheezing	70%	20%	7%	3%	1%	445
h. Shortness of Breath	66%	20%	11%	3%	0%	446
i. Chest Tightness	69%	19%	10%	3%	0%	445
j. Dry, Itching, or Tearing Eyes	33%	22%	28%	16%	2%	446
k. Sore/Strained Eyes	30%	20%	35%	13%	2%	446
l. Blurry/Double Vision	65%	18%	13%	3%	1%	445
m. Burning Eyes	45%	22%	23%	9%	1%	446
n. Sore Throat	28%	39%	27%	5%	0%	446
o. Hoarseness	50%	32%	15%	3%	0%	444
p. Dry Throat	34%	29%	28%	7%	1%	444
q. Unusual Fatigue	26%	23%	31%	16%	4%	446
r. Sleepiness	15%	27%	37%	17%	4%	449
s. Chills	60%	28%	10%	2%	0%	449
t. Fever	54%	39%	6%	1%	0%	449
u. Aching Muscles	41%	27%	19%	10%	2%	447
v. Problems w/ Contact Lenses*	16%	33%	27%	21%	3%	70
w. Difficulty Remembering Things	48%	22%	24%	3%	2%	448
x. Dizziness/Lightheadedness	57%	27%	14%	2%	0%	447
y. Feeling Depressed	34%	33%	24%	7%	2%	447
z. Tension or Nervousness	26%	26%	33%	13%	2%	448
aa. Difficulty Concentrating	29%	31%	31%	6%	2%	446
bb. Dry or Itchy Skin	42%	18%	23%	12%	5%	447
cc. Pain in Upper Back	48%	23%	19%	9%	2%	447
dd. Pain in Lower Back	45%	19%	23%	9%	4%	447
ee. Pain in Shoulder/Neck	53%	20%	18%	7%	2%	449
ff. Pain in Hands or Wrist	66%	17%	11%	4%	1%	446

\*These percentages are based upon only the people who wear contact lenses at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

**Exhibit C-1c: Frequency Distribution of Symptoms Reported Last Year -- FAIRCHILD BUILDING**

SYMPTOMS	NEVER	RARELY	SOMETIMES	OFTEN	ALWAYS	TOTAL REPORTING
a. Headache	11%	31%	39%	18%	2%	409
b. Nausea	57%	30%	11%	2%	0%	408
c. Runny Nose	18%	33%	32%	15%	2%	405
d. Stuffy Nose	12%	22%	36%	23%	7%	407
e. Sneezing	16%	36%	35%	12%	1%	408
f. Cough	20%	43%	29%	5%	3%	408
g. Wheezing	72%	19%	6%	1%	2%	407
h. Shortness of Breath	70%	20%	7%	2%	1%	407
i. Chest Tightness	72%	17%	8%	3%	1%	407
j. Dry, Itching, or Tearing Eyes	32%	19%	31%	16%	2%	408
k. Sore/Strained Eyes	26%	20%	33%	18%	3%	407
l. Blurry/Double Vision	60%	19%	15%	4%	2%	407
m. Burning Eyes	42%	25%	21%	10%	2%	407
n. Sore Throat	32%	40%	22%	5%	1%	408
o. Hoarseness	52%	31%	14%	2%	0%	406
p. Dry Throat	35%	31%	24%	8%	3%	407
q. Unusual Fatigue	25%	25%	34%	13%	3%	408
r. Sleepiness	16%	26%	41%	14%	3%	408
s. Chills	53%	29%	15%	2%	1%	407
t. Fever	56%	37%	7%	0%	0%	407
u. Aching Muscles	44%	29%	22%	4%	1%	407
v. Problems w/ Contact Lenses*	15%	25%	30%	26%	5%	88
w. Difficulty Remembering Things	55%	26%	16%	3%	0%	406
x. Dizziness/Lightheadedness	56%	29%	13%	2%	0%	406
y. Feeling Depressed	39%	31%	23%	4%	2%	407
z. Tension or Nervousness	32%	28%	30%	9%	1%	407
aa. Difficulty Concentrating	33%	30%	30%	5%	1%	405
bb. Dry or Itchy Skin	38%	22%	22%	14%	4%	406
cc. Pain in Upper Back	48%	21%	21%	8%	2%	406
dd. Pain in Lower Back	41%	23%	27%	7%	2%	405
ee. Pain in Shoulder/Neck	55%	17%	19%	6%	2%	406
ff. Pain in Hands or Wrist	74%	13%	10%	3%	0%	406

\*These percentages are based upon only the people who wear contact lenses-at work "sometimes, often or always" (Part II, Question 1.a), as opposed to all respondents in the building.

Reference: Part II, Question 7.

Exhibit C-2

Percent Reporting Symptoms "Often or Always",  
Last Year, By Waterside Mall Sectors

Symptoms	East Tower		West Tower		# 2 Mall		# 3 Mall		NE Mall		SE Mall		Total Responding	
	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	#
a. Headache	20%	772	18%	601	25%	401	25%	503	19%	439	25%	223	21%	2,939
b. Nausea	2%	769	1%	600	2%	396	3%	500	3%	436	2%	223	2%	2,924
c. Runny nose	15%	769	17%	599	19%	396	19%	500	17%	435	16%	223	17%	2,922
d. Stuffy Nose	29%	773	31%	599	30%	396	35%	502	31%	436	33%	222	31%	2,928
e. Sneezing	9%	769	12%	601	11%	395	13%	500	11%	435	13%	223	11%	2,923
f. Cough	7%	772	8%	599	11%	398	11%	499	8%	435	7%	224	8%	2,927
g. Wheezing	2%	770	2%	600	3%	395	4%	498	3%	436	3%	223	2%	2,922
h. Shortness of Breath	3%	771	4%	599	4%	396	4%	498	4%	436	5%	223	4%	2,923
i. Chest Tightness	3%	770	2%	599	4%	395	2%	499	3%	434	4%	223	3%	2,920
j. Dry, Itching, or Tearing Eyes	18%	771	20%	600	26%	398	26%	500	19%	436	26%	223	22%	2,928
k. Sore/Strained Eyes	19%	770	19%	598	27%	396	23%	500	20%	435	25%	223	21%	2,922
l. Blurry/Double Vision	5%	772	7%	597	9%	398	6%	498	7%	433	5%	223	6%	2,921
m. Burning Eyes	11%	773	11%	599	15%	395	14%	500	12%	435	13%	223	12%	2,925
n. Sore Throat	6%	771	6%	599	11%	397	8%	499	5%	436	14%	223	7%	2,925
o. Hoarseness	3%	772	4%	598	8%	396	4%	500	4%	435	5%	223	4%	2,924
p. Dry Throat	12%	771	12%	599	19%	397	15%	500	12%	434	17%	221	14%	2,922
q. Unusual Fatigue	19%	770	20%	600	22%	397	25%	500	19%	437	23%	224	21%	2,928
r. Sleepiness	19%	770	18%	600	20%	397	22%	500	19%	436	24%	225	20%	2,928
s. Chills	3%	772	7%	604	6%	400	6%	497	8%	433	5%	224	6%	2,930
t. Fever	1%	772	1%	602	1%	398	1%	497	1%	434	1%	223	1%	2,926
u. Aching Muscles	10%	771	9%	603	11%	399	11%	499	11%	434	8%	225	10%	2,931
v. Problems w/ Contact Lenses	29%	153	25%	133	43%	89	41%	108	33%	73	40%	50	34%	606
w. Difficulty Remembering Things	5%	768	6%	602	7%	399	6%	498	8%	433	6%	223	6%	2,923
x. Dizziness/Lightheadedness	4%	770	3%	600	6%	400	5%	498	4%	434	6%	223	4%	2,925
y. Feeling Depressed	7%	772	9%	603	7%	397	11%	499	9%	434	8%	223	8%	2,928
z. Tension or Nervousness	13%	771	14%	601	15%	398	13%	498	11%	432	15%	222	13%	2,922
aa. Difficulty Concentrating	8%	770	8%	601	13%	399	13%	497	8%	435	16%	222	10%	2,924
bb. Dry or Itchy Skin	20%	771	23%	601	25%	398	26%	498	21%	431	23%	224	23%	2,923
cc. Pain in Upper Back	8%	772	13%	602	11%	398	11%	498	10%	432	10%	222	10%	2,924
dd. Pain in Lower Back	12%	770	14%	601	9%	400	12%	497	14%	432	14%	223	12%	2,923
ee. Pain in Shoulder/Neck	9%	771	10%	602	11%	399	12%	497	11%	431	11%	223	10%	2,923
ff. Pain in Hands or Wrists	5%	769	5%	602	6%	400	5%	498	5%	432	5%	223	5%	2,924

% Resp. - Percentage of Respondents in Sector.

# in Sector - Number of People in Sector.

# Resp. - Number of Waterside Mall Employees Responding.

Reference: Part II, question 7.

C5

**Exhibit C-3: Frequency Distribution of Gynecological Health Issues, by EPA Headquarters Buildings**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Number of Women Responding</b>	1656	195	198
<b>Percent Menstruated Last Year</b> Ref: Ques. II.23	83%	71%	83%
<b>Percent Pregnant or Nursing Last Year</b> Ref: Ques. II.29.a	8%	4%	8%
<b>Percent on Birth Control Pills Last Year</b> Ref: Ques. II.29.b	20%	15%	24%
<b>Percent Going Through Menopause Last Year</b> Ref: Ques. II.29.c	7%	10%	8%
<b>Percent Post-menopausal Last Year</b> Ref: Ques. II.29.d	7%	15%	7%
<b>Percent on Estrogen Replacement Therapy Last Year</b> Ref: Ques. II.29.e	5%	8%	6%
<b>Percent on Hormones Last Year</b> Ref: Ques. II.30.a	8%	13%	7%
<b>Menstrual Regularity Last Year</b>			
Percent Never	2%	3%	1%
Percent Rarely	5%	6%	4%
Percent About Half the Time	8%	7%	8%
Percent Often	27%	24%	27%
Percent Always	57%	60%	61%
<b>Employees Responding</b> Ref: Ques. II.24	1253	120	143



**Exhibit C-3: Frequency Distribution of Gynecological Health Issues, by EPA Headquarters Buildings (continued)**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Typical Period Length:</b>			
Percent 2 Days or Less	2%	2%	6%
Percent 3 Days	16%	19%	19%
Percent 4 Days	25%	26%	21%
Percent 5 Days	37%	40%	41%
Percent 6 Days	10%	8%	5%
Percent 7 Days	8%	3%	8%
Percent 8 or More Days	2%	2%	1%
Employees Responding Ref: Ques. II.25.a	1200	118	140
<b>Shortest Period Length Last Year:</b>			
Percent 2 Days or Less	19%	21%	27%
Percent 3 Days	32%	30%	30%
Percent 4 Days	22%	23%	16%
Percent 5 Days	20%	18%	21%
Percent 6 Days	4%	4%	4%
Percent 7 Days	3%	1%	2%
Percent 8 or More Days	1%	3%	0%
Employees Responding Ref: Ques. II.25.c	1190	119	141

**Exhibit C-3: Frequency Distribution of Gynecological Health Issues, by EPA Headquarters Buildings (continued)**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Longest Period Length Last Year:</b>			
Percent 2 Days or Less	1%	2%	2%
Percent 3 Days	5%	3%	6%
Percent 4 Days	13%	14%	14%
Percent 5 Days	32%	29%	30%
Percent 6 Days	16%	14%	14%
Percent 7 Days	21%	25%	24%
Percent 8 or More Days	13%	14%	9%
Employees Responding Ref: Ques. II.25.b	1201	118	141
<b>Typical Cycle Length:</b>			
Percent 23 Days or Less	18%	17%	22%
Percent 24-25 Days	7%	8%	6%
Percent 26-27 Days	9%	8%	7%
Percent 28-29 Days	47%	48%	48%
Percent 30-31 Days	13%	15%	11%
Percent 32-33 Days	4%	2%	1%
Percent 34 or More Days	3%	2%	4%
Employees Responding Ref: Ques. II.26.a	1127	112	137

**Exhibit C-3: Frequency Distribution of Gynecological Health Issues, by EPA Headquarters Buildings (continued)**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Shortest Cycle Length Last Year:</b>			
Percent 23 Days or Less	39%	43%	38%
Percent 24-25 Days	13%	12%	10%
Percent 26-27 Days	16%	11%	18%
Percent 28-29 Days	26%	25%	27%
Percent 30-31 Days	6%	9%	3%
Percent 32-33 Days	1%	0%	0%
Percent 34 or More Days	1%	1%	3%
Employees Responding Ref: Ques. II.26.c	1036	103	128
<b>Longest Cycle Length Last Year:</b>			
Percent 27 Days or Less	22%	22%	26%
Percent 28-29 Days	24%	23%	19%
Percent 30-31 Days	22%	25%	22%
Percent 32-33 Days	10%	13%	8%
Percent 34-35 Days	8%	4%	5%
Percent 36-45 Days	8%	6%	12%
Percent 46-60 Days	3%	5%	7%
Percent 61 or More Days	2%	3%	2%
Employees Responding Ref: Ques. II.26.b	1030	102	129

**Exhibit C-4 : Frequency Distribution of Menstrual Symptoms, Last Year, by EPA Headquarters Buildings**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Bleeding/Spotting Between Periods:</b>			
Percent Never	68%	63%	63%
Percent 1-3 Times	24%	25%	30%
Percent 4-6 Times	5%	7%	4%
Percent 7-9 Times	2%	3%	1%
Percent 10 or More Times	2%	3%	2%
Employees Responding Ref: Ques. II.27	1240	120	142
<b>Frequency of Menstrual Symptoms:</b>			
Percent Never	7%	8%	8%
Percent 1-3 Times	18%	13%	22%
Percent 4-6 Times	15%	15%	17%
Percent 7-9 Times	15%	17%	10%
Percent 10 or More Times	45%	48%	41%
Employees Responding Ref: Ques. II.28.a	1234	120	143

**Exhibit C-4: Frequency Distribution of Menstrual Symptoms, Last Year, by EPA Headquarters Buildings (continued)**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Severity of Menstrual Symptoms:</b>			
Percent Mild	32%	33%	37%
Percent Moderate	55%	52%	53%
Percent Severe	11%	11%	8%
Percent Extreme	2%	4%	2%
Employees Responding Ref: Ques. II.28.b	1144	111	131

**Exhibit C-5: Gynecological Health Problems, by EPA Headquarters Buildings**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Percent with Fibroids</b>	21%	21%	26%
<b>Year Diagnosed:</b>			
Percent Before 1970	10%	8%	3%
Percent 1970 - 1979	22%	20%	18%
Percent 1980 - 1989	68%	72%	79%
<b>Changes in Size Last Year:</b>			
Percent Decreased	7%	6%	7%
Percent Increased	17%	19%	7%
Percent No Change	57%	53%	60%
Percent Other	19%	22%	17%
<b>Employees Responding</b>	1464	168	169
<b>Percent with Cysts</b>	18%	12%	18%
<b>Year Diagnosed:</b>			
Percent Before 1970	13%	21%	0%
Percent 1970 - 1979	22%	21%	27%
Percent 1980 - 1989	65%	57%	73%
<b>Changes in Size Last Year:</b>			
Percent Decreased	9%	17%	12%
Percent Increased	10%	0%	19%
Percent No Change	55%	56%	58%
Percent Other	26%	28%	12%
<b>Employees Responding</b>	1434	159	160

Reference: Part II, question 31.

**Exhibit C-5: Gynecological Health Problems, by EPA Headquarters Buildings (continued)**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
<b>Percent with Enlarged Uterus</b>	4%	6%	3%
<b>Year Diagnosed:</b>			
Percent Before 1970	4%	0%	0%
Percent 1970 - 1979	11%	0%	0%
Percent 1980 - 1989	85%	100%	100%
<b>Changes in Size Last Year:</b>			
Percent Decreased	8%	22%	0%
Percent Increased	25%	0%	33%
Percent No Change	48%	67%	67%
Percent Other	19%	11%	0%
<b>Employees Responding</b>	1372	157	151

Reference: Part II, question 31.

Exhibit C-6: Percent Reporting Symptoms One or More Days Last Week, by Sector, Waterside Mall

SYMPTOM	EAST TOWER		WEST TOWER		MALL 2ND FLOOR		MALL 3RD FLOOR		NE MALL		SE MALL		TOTAL RESPONDING	
	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Sector	% Reporting Symptom	Total # in Bldg.
Headache	49%	772	54%	601	59%	401	53%	503	54%	439	53%	223	54%	2,939
Nausea	11%	769	10%	600	15%	396	18%	500	13%	436	13%	223	13%	2,924
Runny Nose	42%	769	44%	599	44%	396	47%	500	40%	435	39%	223	43%	2,922
Stuffy Nose	49%	773	54%	599	52%	396	58%	502	54%	436	53%	222	52%	2,928
Sneezing	38%	769	44%	601	44%	395	41%	500	34%	435	39%	223	41%	2,923
Cough	30%	772	34%	599	37%	398	35%	499	27%	435	26%	224	32%	2,927
Wheezing	8%	770	10%	600	7%	395	12%	498	7%	436	0%	223	8%	2,922
Shortness of Breath	8%	771	10%	599	15%	396	12%	498	13%	436	13%	223	11%	2,923
Chest Tightness	8%	770	10%	599	7%	395	12%	499	7%	434	13%	223	9%	2,920
Dry, Itching, or Tearing Eyes	38%	771	44%	600	44%	398	41%	500	40%	436	39%	223	41%	2,928
Sore/Strained Eyes	38%	770	44%	598	44%	396	41%	500	40%	435	39%	223	41%	2,922
Blurry/Double Vision	15%	772	20%	597	15%	398	18%	498	13%	433	13%	223	17%	2,921
Burning Eyes	23%	773	29%	599	37%	395	29%	500	27%	435	26%	223	28%	2,925
Sore Throat	23%	771	24%	599	29%	397	29%	499	27%	436	26%	223	25%	2,925
Hoarseness	15%	772	15%	598	22%	396	18%	500	13%	435	13%	223	16%	2,924
Dry Throat	30%	771	29%	599	37%	397	35%	500	27%	434	40%	221	30%	2,922
Unusual Fatigue	46%	770	39%	600	44%	397	47%	500	47%	437	52%	224	44%	2,928
Sleepiness	49%	770	49%	600	52%	397	53%	500	54%	436	52%	225	50%	2,928
Chills	15%	772	19%	604	22%	400	18%	497	20%	433	13%	224	19%	2,930
Fever	8%	772	10%	602	7%	398	6%	497	7%	434	13%	223	8%	2,926
Aching Muscles	27%	771	24%	603	29%	399	23%	499	27%	434	26%	225	25%	2,931
Problems w/ Contact Lenses*	44%	153	46%	133	54%	89	51%	108	50%	73	48%	50	48%	606
Difficulty Remembering Things	23%	768	24%	602	20%	399	18%	498	20%	433	26%	223	19%	2,923
Dizziness/Lightheadedness	15%	770	20%	600	15%	400	18%	498	13%	434	26%	223	18%	2,925
Feeling Depressed	27%	772	29%	603	30%	397	23%	499	27%	434	26%	223	27%	2,928
Tension or Nervousness	42%	771	39%	601	37%	398	35%	498	34%	432	39%	222	38%	2,922
Difficulty Concentrating	34%	770	34%	601	37%	399	35%	497	27%	435	40%	222	34%	2,924
Dry or Itchy Skin	38%	771	39%	601	37%	398	35%	498	34%	431	39%	224	36%	2,923
Pain in Upper Back	19%	772	24%	602	22%	398	23%	498	20%	432	26%	222	22%	2,924
Pain in Lower Back	27%	770	29%	601	29%	400	24%	497	27%	432	26%	223	28%	2,923
Pain in Shoulder/Neck	23%	771	24%	602	22%	399	18%	497	20%	431	26%	223	22%	2,923
Pain in Hands or Wrist	11%	769	15%	602	7%	400	12%	498	7%	432	13%	223	11%	2,924

C-14

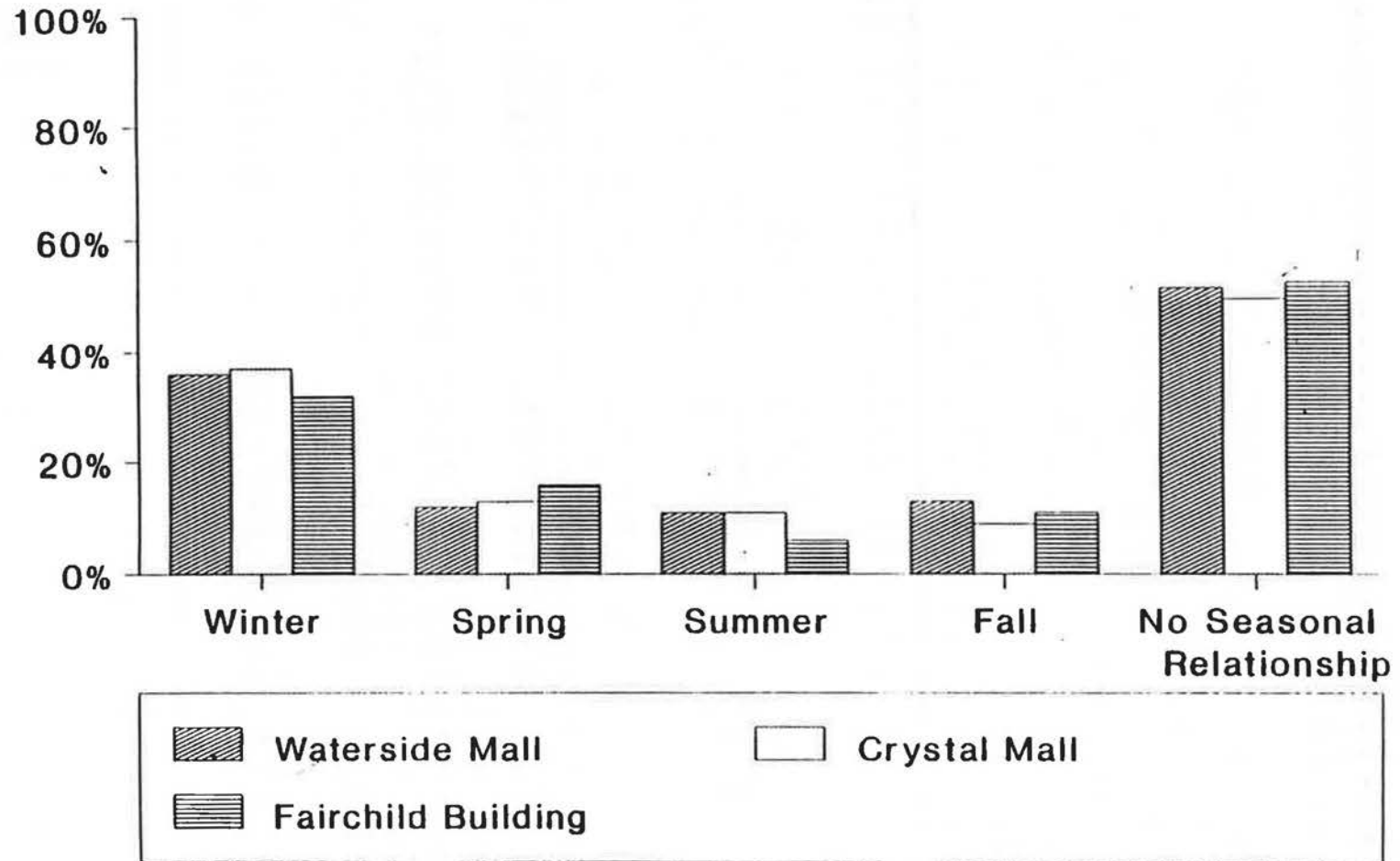
\*Based upon only the people who wear contact lenses at work (Part II, Question 1.a) as opposed to all responding employees.

Reference: Part II, Question 7.



### Exhibit C-7

## Prevalence of Symptoms by Season EPA Headquarters

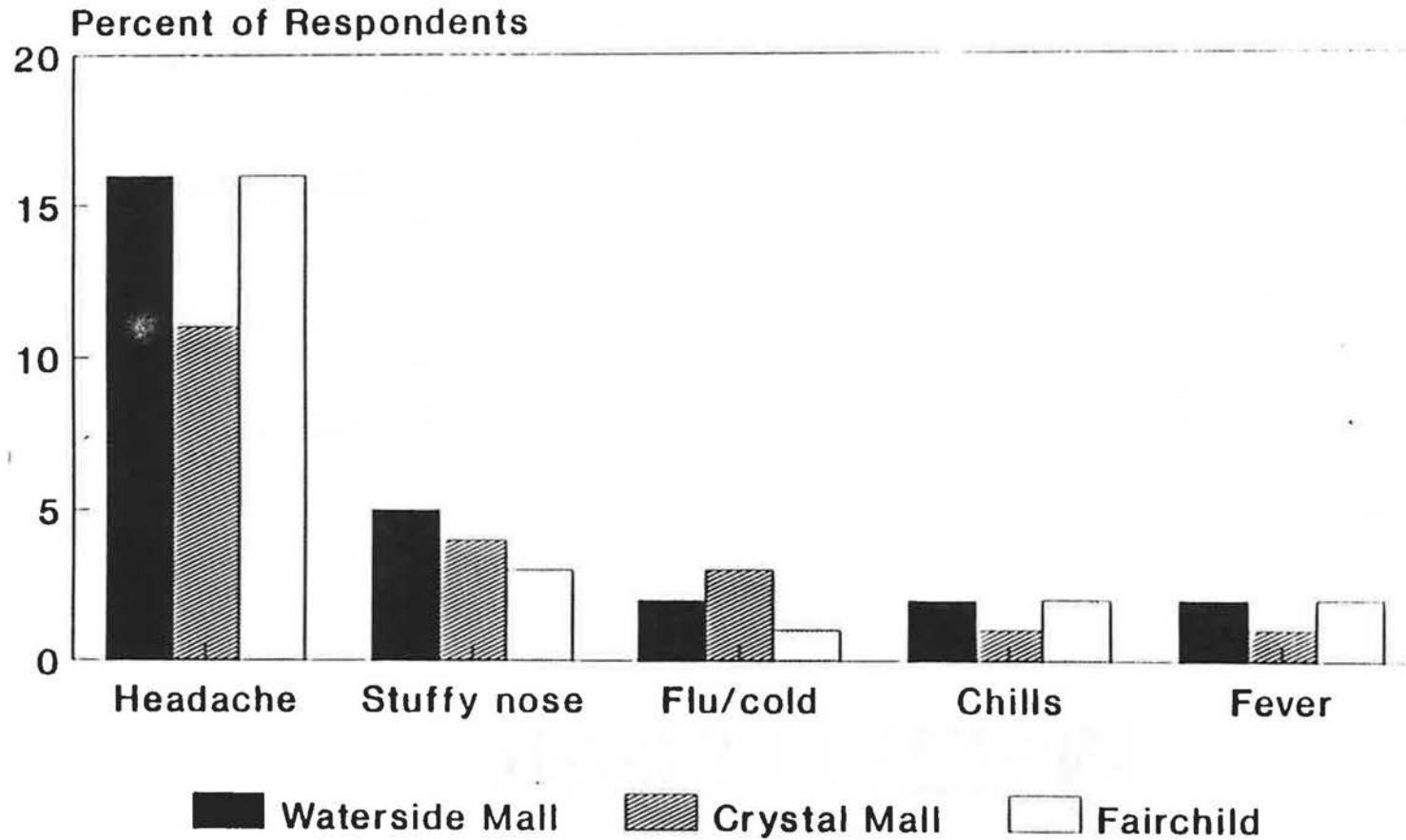


C-15

Reference: Part II, question 10.

Exhibit C-8

# CAUSES FOR LEAVING WORK OR STAYING HOME

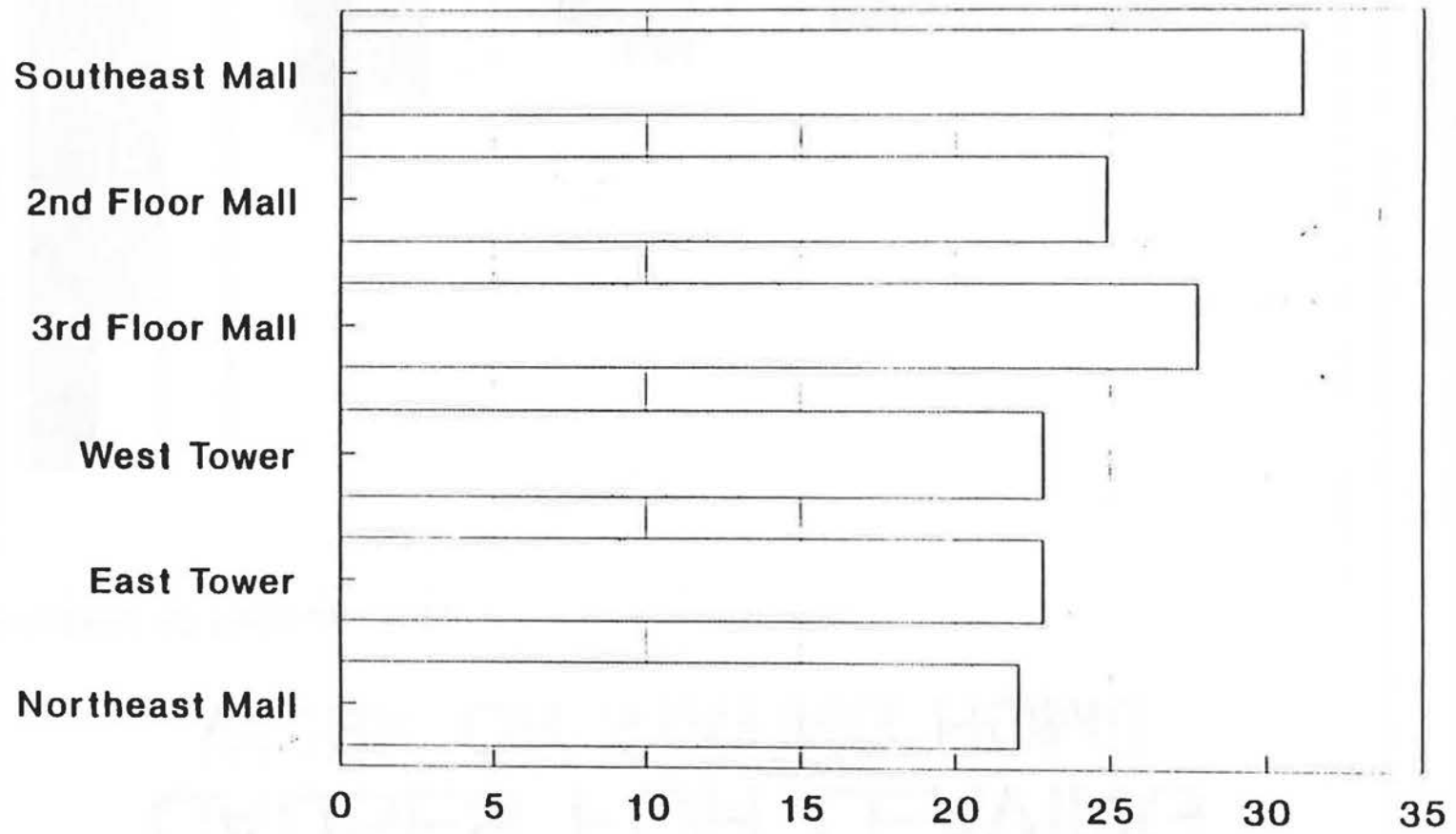


C-16

Reference: Part II, question 9b

Exhibit C-9

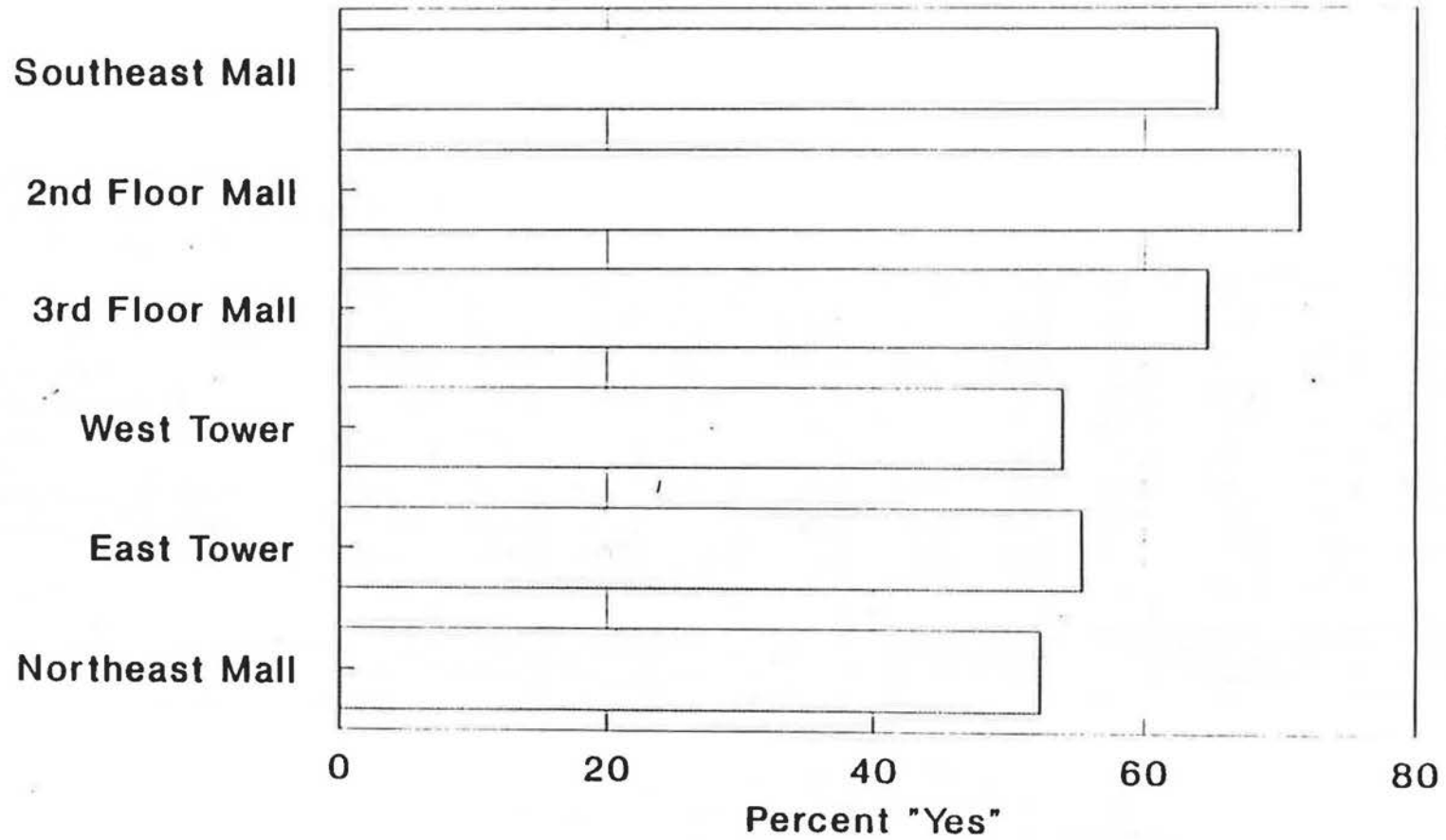
# SYMPTOMS CAUSE ABSENTEEISM



Percent answering "sometimes" or "often"

Reference: Part II, Question 9a

# ASSOCIATE SYMPTOMS WITH BUILDING



C-18

Reference: Part II, Question 11a.

**Exhibit C-11a**

**Number and Percent of Responding Employees Attributing  
Eye, Nose, Throat or Respiratory Irritation to Various Causes  
at Workstation, Last Year, Waterside Mall**

	Never		Rarely		Sometimes		Often		Always		Total Irritated	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Tobacco Smoke	2,146	71%	433	14%	281	9%	94	3%	61	2%	869	29%
Fumes from Copy Machine	2,287	76%	438	15%	207	7%	46	2%	22	1%	713	24%
Fumes from Printing Process	2,703	90%	209	7%	55	2%	18	1%	13	0%	295	10%
Fumes from Other Chemicals	2,063	69%	549	18%	297	10%	65	2%	24	1%	935	31%
Fumes from Pesticides	2,431	82%	376	13%	127	4%	26	1%	19	1%	548	18%
Fumes from New Carpeting	1,852	62%	490	16%	441	15%	152	5%	58	2%	1,141	38%
Fumes from New Drapes	2,324	78%	394	13%	183	6%	62	2%	26	1%	665	22%
Fumes from Paint	1,888	63%	591	20%	401	13%	84	3%	40	1%	1,116	37%
Fumes from Cleaning of Carpets	2,242	75%	454	15%	209	7%	49	2%	21	1%	733	25%
Other Fumes	1,880	85%	45	2%	139	6%	109	5%	48	2%	341	15%

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part II, question 19.

**Exhibit C-11b**

**Number and Percent of Responding Employees Attributing  
Eye, Nose, Throat or Respiratory Irritation to Various Causes  
at Workstation, Last Year, Crystal Mall**

	Never		Rarely		Sometimes		Often		Always		Total Irritated	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Tobacco Smoke	299	67%	80	18%	45	10%	13	3%	10	2%	148	33%
Fumes from Copy Machine	320	73%	69	16%	34	8%	12	3%	4	1%	119	27%
Fumes from Printing Process	395	91%	27	6%	7	2%	2	0%	2	0%	38	9%
Fumes from Other Chemicals	331	75%	71	16%	31	7%	5	1%	1	0%	108	25%
Fumes from Pesticides	362	83%	63	14%	9	2%	2	0%	1	0%	75	17%
Fumes from New Carpeting	339	78%	66	15%	22	5%	8	2%	2	0%	98	22%
Fumes from New Drapes	375	86%	47	11%	10	2%	3	1%	1	0%	61	14%
Fumes from Paint	276	62%	95	21%	57	13%	7	2%	7	2%	166	38%
Fumes from Cleaning of Carpets	343	79%	70	16%	14	3%	4	1%	3	1%	91	21%
Other Fumes	314	86%	7	2%	12	3%	20	5%	12	3%	51	14%

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part II, question 19.

**Exhibit C-11c**

**Number and Percent of Responding Employees Attributing  
Eye, Nose, Throat or Respiratory Irritation to Various Causes  
at Workstation, Last Year, Fairchild Building**

	Never		Rarely		Sometimes		Often		Always		Total Irritated	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Tobacco Smoke	284	70%	63	16%	34	8%	11	3%	11	3%	119	30%
Fumes from Copy Machine	319	79%	56	14%	18	4%	5	1%	4	1%	83	21%
Fumes from Printing Process	367	92%	23	6%	5	1%	3	1%	0	0%	31	8%
Fumes from Other Chemicals	314	78%	59	15%	23	6%	3	1%	2	0%	87	22%
Fumes from Pesticides	350	88%	35	9%	9	2%	2	1%	2	1%	48	12%
Fumes from New Carpeting	281	71%	55	14%	39	10%	17	4%	5	1%	116	29%
Fumes from New Drapes	312	78%	43	11%	30	7%	12	3%	4	1%	89	22%
Fumes from Paint	313	78%	46	12%	26	7%	10	3%	5	1%	87	22%
Fumes from Cleaning of Carpets	315	79%	47	12%	29	7%	5	1%	4	1%	85	21%
Other Fumes	347	94%	2	1%	13	4%	6	2%	2	1%	23	6%

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part II, question 19.

**Exhibit C-12a**  
**Physical Environment of Workstation, Last Year,**  
**Waterside Mall**

	Never		Rarely		Sometimes		Often		Always		Total Complaining	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Too Much Air Movement	1,316	44%	783	26%	530	18%	269	9%	97	3%	1,679	56%
Too Little Air Movement	322	11%	430	14%	886	30%	881	29%	476	16%	2,673	89%
Adjust the Air Movement	237	8%	252	8%	931	31%	1,006	34%	568	19%	2,757	92%
Temperature Too Hot	234	8%	412	14%	1,318	43%	940	31%	136	4%	2,806	92%
Temperature Too Cold	197	6%	538	18%	1,352	44%	814	27%	144	5%	2,848	94%
Adjust the Temperature	94	3%	190	6%	1,029	34%	1,146	38%	562	19%	2,927	97%
Too Humid	1,239	41%	939	31%	590	20%	176	6%	54	2%	1,759	59%
Too Dry	467	15%	512	17%	931	31%	693	23%	415	14%	2,551	85%
Adjust the Humidity	572	19%	451	15%	884	30%	646	22%	431	14%	2,412	81%
Air Too Stuffy	276	9%	415	14%	960	32%	830	27%	549	18%	2,754	91%
Too Noisy	482	16%	811	27%	835	28%	523	17%	376	12%	2,545	84%
Too Quiet	2,051	68%	758	25%	141	5%	33	1%	22	1%	954	32%
Work Area Too Dusty	703	23%	763	25%	830	27%	421	14%	302	10%	2,316	77%

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part III, question 1.



**Exhibit C-12b**  
**Physical Environment of Workstation, Last Year,**  
**Crystal Mall**

	Never		Rarely		Sometimes		Often		Always		Total Complaining	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Too Much Air Movement	281	64%	98	22%	44	10%	8	2%	5	1%	155	36%
Too Little Air Movement	57	13%	54	12%	116	26%	115	26%	98	22%	383	87%
Adjust the Air Movement	57	13%	47	11%	120	28%	117	27%	93	21%	377	87%
Temperature Too Hot	34	8%	76	17%	190	43%	113	26%	30	7%	409	92%
Temperature Too Cold	101	23%	153	35%	154	35%	29	7%	4	1%	340	77%
Adjust the Temperature	29	7%	53	12%	182	42%	115	26%	59	13%	409	93%
Too Humid	221	51%	117	27%	61	14%	27	6%	8	2%	213	49%
Too Dry	85	19%	78	18%	108	25%	115	26%	53	12%	354	81%
Adjust the Humidity	104	24%	58	13%	110	25%	100	23%	60	14%	328	76%
Air Too Stuffy	56	13%	56	13%	128	29%	106	24%	94	21%	384	87%
Too Noisy	76	17%	115	26%	135	31%	75	17%	40	9%	365	83%
Too Quiet	310	71%	112	26%	10	2%	2	0%	2	0%	126	29%
Work Area Too Dusty	106	24%	131	30%	135	31%	33	8%	34	8%	333	76%

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part III, question 1.

**Exhibit C-12c**  
**Physical Environment of Workstation, Last Year,**  
**Fairchild Building**

	Never		Rarely		Sometimes		Often		Always		Total Complaining	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Too Much Air Movement	237	59%	131	33%	27	7%	5	1%	2	0%	165	41%
Too Little Air Movement	52	13%	75	19%	117	29%	82	21%	74	19%	348	87%
Adjust the Air Movement	54	14%	52	13%	129	32%	91	23%	73	18%	345	86%
Temperature Too Hot	28	7%	69	17%	181	45%	95	24%	28	7%	373	93%
Temperature Too Cold	60	15%	116	29%	178	44%	41	10%	7	2%	342	85%
Adjust the Temperature	21	5%	45	11%	173	43%	98	24%	64	16%	380	95%
Too Humid	185	46%	116	29%	69	17%	20	5%	8	2%	213	54%
Too Dry	79	20%	76	19%	118	30%	66	17%	59	15%	319	80%
Adjust the Humidity	96	24%	65	16%	107	27%	75	19%	56	14%	303	76%
Air Too Stuffy	60	15%	66	17%	119	30%	81	20%	73	18%	339	85%
Too Noisy	81	20%	141	35%	108	27%	47	12%	24	6%	320	80%
Too Quiet	240	60%	117	29%	29	7%	8	2%	5	1%	159	40%
Work Area Too Dusty	128	32%	115	29%	106	26%	30	7%	22	5%	273	68%

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part III, question 1.

**Exhibit C-13**

**Environmental Comfort of Workstation Last Year,  
Percent Reporting Often/Always,  
By Waterside Mall Sectors**

	East Tower		West Tower		# 2 Mall		# 3 Mall		NE Mall		SE Mall		Total Responding	
	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# in Sector	% Resp.	# of Resp.
Too Much Air Movement	13%	764	15%	585	13%	393	8%	485	12%	427	8%	214	12%	2868
Too Little Air Movement	40%	761	38%	583	55%	391	56%	489	42%	427	57%	217	46%	2868
Adjust the Air Movement	34%	759	49%	581	61%	392	58%	489	51%	432	58%	216	49%	2869
Temperature Too Hot	33%	768	39%	595	40%	397	36%	494	30%	435	34%	220	36%	2909
Temperature Too Cold	23%	768	35%	596	36%	398	32%	494	34%	437	34%	222	31%	2915
Adjust the Temperature	52%	765	59%	594	62%	394	59%	491	54%	431	57%	221	57%	2896
Too Humid	6%	757	8%	586	8%	394	9%	490	6%	434	9%	215	7%	2876
Too Dry	37%	764	37%	590	37%	399	39%	488	32%	435	45%	218	37%	2894
Adjust the Humidity	33%	756	34%	589	40%	392	41%	484	33%	429	42%	217	36%	2867
Air Too Stuffy	41%	769	42%	592	50%	395	55%	494	40%	430	52%	222	46%	2902
Too Noisy	30%	767	31%	589	32%	397	24%	493	30%	434	34%	219	30%	2899
Too Quiet	2%	760	2%	588	1%	395	1%	490	2%	431	1%	217	2%	2881
Work Area Too Dusty	22%	763	26%	589	23%	395	28%	491	19%	433	28%	219	24%	2890

% Resp. - Percentage of Respondents Reporting Comfort Factor "Often or Always".

# in Sector - Number of Respondents in Sector Reporting Comfort Factor.

# of Resp. - Number of Waterside Mall Employees Reporting Comfort Factor.

Reference: Part III, question 1.

**Exhibit C-14a**  
**Odors Noticed at Present Workstation, Last Year,**  
**Waterside Mall**

	Never		Rarely		Sometimes		Often		Always		Total Reporting Odors	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Body Odor	1,950	64%	699	23%	294	10%	65	2%	19	1%	1,077	36%
Cosmetics	1,143	38%	894	30%	702	23%	213	7%	78	3%	1,887	62%
Tobacco Smoke	1,977	65%	638	21%	301	10%	84	3%	33	1%	1,056	35%
Fishy Smells	2,177	72%	493	16%	283	9%	65	2%	14	0%	855	28%
Other Food Smells	746	25%	701	23%	1,046	34%	451	15%	93	3%	2,291	75%
Musty/Damp Basement Smells	2,093	69%	570	19%	268	9%	79	3%	28	1%	945	31%
New Carpet Odors	1,920	63%	539	18%	422	14%	124	4%	36	1%	1,121	37%
New Drape/Curtain Odors	2,546	84%	346	11%	104	3%	18	1%	6	0%	474	16%
Diesel/Engine Exhaust Odors	2,453	81%	341	11%	165	5%	64	2%	10	0%	580	19%
Copy Machine Odors	2,258	74%	475	16%	221	7%	58	2%	19	1%	773	26%
Odors from Printing Processing	2,711	90%	238	8%	55	2%	13	0%	8	0%	314	10%
Odors from Other Chemicals	1,687	56%	870	29%	384	13%	66	2%	15	0%	1,335	44%
Pesticide Odors	2,411	80%	453	15%	133	4%	12	0%	4	0%	602	20%
Odors from Cleahing of Carpet/Drape	2,190	73%	576	19%	205	7%	33	1%	6	0%	820	27%
Paint Odors	1,768	59%	774	26%	412	14%	62	2%	6	0%	1,254	41%
Other Unpleasant Odors	2,228	81%	222	8%	206	8%	49	2%	35	1%	512	19%

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part III, question 2.

**Exhibit C-14b**  
**Odors Noticed at Present Workstation, Last Year,**  
**Crystal Mall**

	Never		Rarely		Sometimes		Often		Always		Total Reporting Odors	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Body Odor	263	59%	108	24%	58	13%	9	2%	5	1%	180	41%
Cosmetics	135	30%	143	32%	121	27%	37	8%	7	2%	308	70%
Tobacco Smoke	258	58%	110	25%	50	11%	19	4%	7	2%	186	42%
Fishy Smells	296	67%	96	22%	40	9%	8	2%	3	1%	147	33%
Other Food Smells	90	20%	123	28%	151	34%	68	15%	12	3%	354	80%
Musty/Damp Basement Smells	352	79%	70	16%	17	4%	2	0%	3	1%	92	21%
New Carpet Odors	342	77%	81	18%	16	4%	2	0%	2	0%	101	23%
New Drape/Curtain Odors	374	84%	62	14%	5	1%	1	0%	1	0%	69	16%
Diesel/Engine Exhaust Odors	387	87%	41	9%	12	3%	2	0%	1	0%	56	13%
Copy Machine Odors	324	72%	74	17%	31	7%	17	4%	1	0%	123	28%
Odors from Printing Processing	404	91%	33	7%	6	1%	0	0%	0	0%	39	9%
Odors from Other Chemicals	275	62%	125	28%	42	9%	2	0%	1	0%	170	38%
Pesticide Odors	362	82%	72	16%	10	2%	0	0%	0	0%	82	18%
Odors from Cleaning of Carpet/Drape	339	77%	80	18%	19	4%	3	1%	0	0%	102	23%
Paint Odors	260	58%	113	25%	63	14%	6	1%	3	1%	185	42%
Other Unpleasant Odors	351	84%	29	7%	23	6%	11	3%	3	1%	66	16%

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part III, question 2.

**Exhibit C-14c**  
**Odors Noticed at Present Workstation, Last Year,**  
**Fairchild Building**

	Never		Rarely		Sometimes		Often		Always		Total Reporting Odors	
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.
Body Odor	271	67%	80	20%	38	9%	13	3%	3	1%	134	33%
Cosmetics	143	35%	125	31%	91	23%	35	9%	10	2%	261	65%
Tobacco Smoke	283	70%	75	19%	31	8%	9	2%	6	1%	121	30%
Fishy Smells	313	77%	60	15%	26	6%	3	1%	2	0%	91	23%
Other Food Smells	106	26%	109	27%	141	35%	43	11%	6	1%	299	74%
Musty/Damp Basement Smells	326	80%	56	14%	22	5%	1	0%	0	0%	79	20%
New Carpet Odors	289	72%	64	16%	35	9%	9	2%	5	1%	113	28%
New Drape/Curtain Odors	325	81%	52	13%	19	5%	2	0%	5	1%	78	19%
Diesel/Engine Exhaust Odors	363	90%	24	6%	14	3%	4	1%	0	0%	42	10%
Copy Machine Odors	310	77%	58	14%	30	7%	2	0%	3	1%	93	23%
Odors from Printing Processing	371	92%	22	5%	6	1%	1	0%	2	0%	31	8%
Odors from Other Chemicals	262	65%	103	26%	33	8%	2	0%	3	1%	141	35%
Pesticide Odors	368	91%	28	7%	6	1%	0	0%	1	0%	35	9%
Odors from Cleaning of Carpet/Drape	315	78%	59	15%	26	6%	1	0%	2	0%	88	22%
Paint Odors	306	76%	64	16%	31	8%	2	0%	1	0%	98	24%
Other Unpleasant Odors	355	89%	23	6%	14	4%	5	1%	1	0%	43	11%

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part III, question 2.

**Exhibit C-15: Changes in Workstation Physical Environment, by EPA Headquarters Buildings**

	<b>WATERSIDE MALL</b>	<b>CRYSTAL MALL</b>	<b>FAIRCHILD</b>
<b>Changes Last Year</b>			
Improved	20%	13%	17%
Became Worse	14%	20%	12%
Stayed the Same	66%	67%	72%
Employees Responding	3045	448	405
<b>Changes During a Typical Work Day</b>			
Improves	5%	3%	4%
Becomes Worse	22%	26%	21%
Stays the Same	72%	72%	75%
Employees Responding	3045	447	405

Reference: Part III, questions 12 and 13.

**Exhibit C-16: Degree of Responding Employees' Chair & Workstation Comfort, by EPA Headquarters Buildings**

	EMPLOYEES RESPONDING	REASONABLY COMFORTABLE	PERCENT RESPONDING		
			SOMEWHAT UNCOMFORTABLE	VERY UNCOMFORTABLE	NOT APPROPRIATE
<b>Chair Comfort</b>					
Waterside Mall	3068	67%	21%	11%	1%
Crystal Mall	450	63%	24%	12%	1%
Fairchild	404	71%	21%	7%	1%
<b>Comfort of Set-up of Desk, Equipment</b>					
Waterside Mall	3059	71%	22%	7%	0%
Crystal Mall	450	70%	22%	8%	0%
Fairchild	403	69%	24%	7%	0%

Reference: Part III, questions 7:a and 8.



**Exhibit C-17: Percent of Responding Employees Reporting Glare At Workstation, by EPA Headquarters Buildings**

	EMPLOYEES RESPONDING	PERCENT RESPONDING			
		NEVER	SOMETIMES	OFTEN	ALWAYS
Waterside Mall	3044	51%	36%	7%	4%
Crystal Mall	448	55%	37%	6%	2%
Fairchild	404	44%	44%	8%	4%

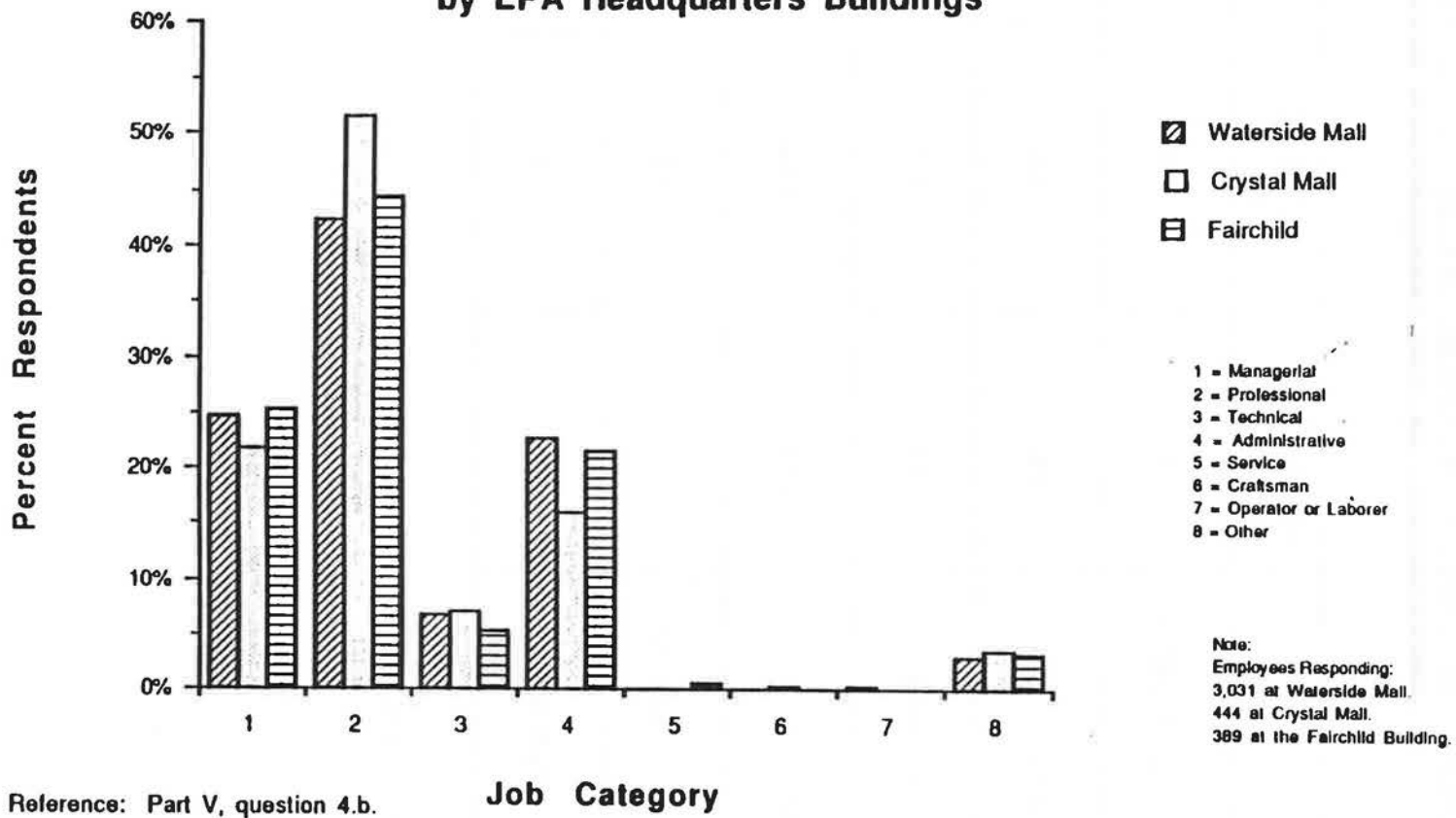
Reference: Part III, question 5.a.

**Exhibit C-18: Responding Employees Rating of Lighting at Workstation, by EPA Headquarters Buildings**

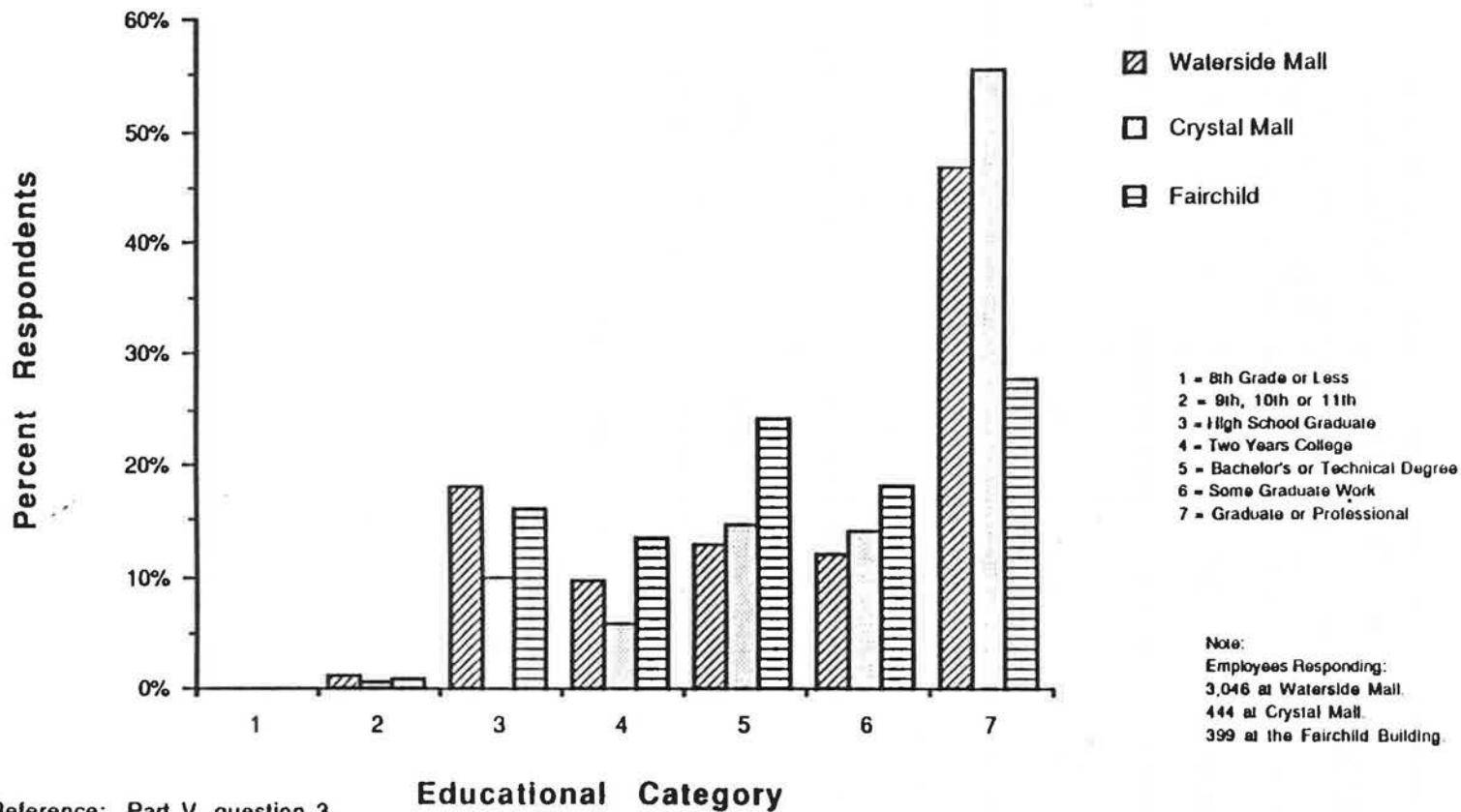
	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD
Employees Responding	3051	449	404
Much Too Dim	7%	5%	5%
A Little Too Dim	34%	35%	27%
Just Right	51%	54%	59%
A Little Too Bright	7%	5%	6%
Much Too Bright	1%	1%	1%

Reference: Part III, question 4.

### Exhibit C-19 Distribution Of Job Categories, by EPA Headquarters Buildings



### Exhibit C-20 Education Distribution, by EPA Headquarters Buildings



Reference: Part V, question 3.

**Exhibit C-21: Medical History: Number and Percent of Responding Employees, by EPA Headquarters Building**

SYMPTOM CLUSTER	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Number	Percent	Number	Percent	Number	Percent
Ever Had or Have Eczema	247	8%	33	7%	33	8%
Sensitivity to Eye, Nose, Throat or Respiratory Irritants	969	32%	142	32%	118	29%
Physician Ever Diagnosed Asthma	260	8%	59	13%	35	9%
Asthma Diagnosed Since Working in the Building	46	18%	8	14%	4	11%

Reference: Part II, Questions 14, 20, 16.a and 16.b, respectively.

**Exhibit C-22a**  
**Reported Frequency of Sensitivity to**  
**Various Allergies, Waterside Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Pollen or Plants	1,620	56%	1,286	44%	2,906
Animals	2,300	82%	498	18%	2,798
Dust	1,588	54%	1,344	46%	2,932
Molds	1,920	68%	914	32%	2,834
Other	1,980	86%	311	14%	2,291

**Exhibit C-22b**  
**Reported Frequency of Sensitivity to**  
**Various Allergies, Crystal Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Pollen or Plants	216	50%	212	50%	428
Animals	311	77%	91	23%	402
Dust	212	50%	216	50%	428
Molds	254	61%	164	39%	418
Other	281	84%	52	16%	333

**Exhibit C-22c**  
**Reported Frequency of Sensitivity to**  
**Various Allergies, Fairchild Building**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Pollen or Plants	208	54%	174	46%	382
Animals	292	79%	76	21%	368
Dust	213	55%	177	45%	390
Molds	255	68%	118	32%	373
Other	342	90%	36	10%	378

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part II, question 18.

**Exhibit C-23: Frequencies of Use of Corrective Lenses at Work, by EPA Headquarters Building**

	EMPLOYEES RESPONDING	PERCENT RESPONDING			
		NEVER	SOMETIMES	OFTEN	ALWAYS
<b>Have or Wear Contact Lenses</b>					
Waterside Mall	690	9%	21%	12%	57%
Crystal Mall	87	20%	18%	14%	48%
Fairchild	101	13%	24%	14%	50%
<b>Wear Eyeglasses For Close-Up Work</b>					
Waterside Mall	3,036	39%	13%	11%	38%
Crystal Mall	446	31%	15%	10%	44%
Fairchild	401	39%	12%	11%	38%

Reference: Part II, questions 1.b and 2.

**Exhibit C-24: Summary of Responding Employees' Smoking Habits, by EPA Headquarters Buildings**

	WATERSIDE MALL	CRYSTAL MALL	FAIRCHILD BUILDING
<b>Percent:</b>			
Never Smoked	58%	54%	60%
Former Smoker	28%	31%	22%
Current Smoker	14%	14%	18%
Employees Responding	3,062	443	404
<b>Among Current Smokers:</b>			
Percent Smoke at Workstation			
Never	90%	85%	93%
Sometimes	9%	15%	7%
Often	1%	0%	0%
Percent Smoke Elsewhere at Work			
Never	21%	26%	11%
Sometimes	57%	53%	57%
Often	22%	21%	31%
Cigarettes per Day, Percent			
None	10%	11%	7%
1 to 5	31%	29%	19%
6 to 10	21%	15%	29%
11 to 20	26%	29%	33%
21 to 30	8%	8%	9%
31 or more	3%	8%	3%

Reference: Part II, questions .3, 4, 5 and 6.



**Exhibit C-25a**

Frequency Distributions of the Components of the  
Role Conflict Scale, Waterside Mall

Conflicting tasks from Persons:	Rarely		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Equal in rank	1,718	57%	1,025	34%	197	7%	79	3%	3,019
In position of authority	1,773	59%	941	31%	202	7%	93	3%	3,009
Whose requests should be met	1,078	36%	1,232	41%	492	16%	204	7%	3,006

**Exhibit C-25b**

Frequency Distributions of the Components of the  
Role Conflict Scale, Crystal Mall

Conflicting tasks from Persons:	Rarely		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Equal in rank	253	57%	155	35%	30	7%	9	2%	447
In position of authority	263	59%	135	30%	31	7%	14	3%	443
Whose requests should be met	149	33%	199	45%	61	14%	36	8%	445

**Exhibit C-25c**

Frequency Distributions of the Components of the  
Role Conflict Scale, Fairchild Building

Conflicting tasks from Persons:	Rarely		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Equal in rank	247	62%	117	29%	25	6%	9	2%	398
In position of authority	238	60%	115	29%	33	8%	12	3%	398
Whose requests should be met	147	37%	165	42%	57	14%	28	7%	397

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part IV, question 4.

**Exhibit C-26a**

**Frequency Distribution of the Components of the  
Job Control Scale, Waterside Mall**

How Much Influence Do You Have in the Following Areas:	Very Little		Little		A Moderate Amount		Much		Very Much		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Over Amount of Work You Do	373	12%	449	15%	1,147	38%	687	23%	363	12%	3,019
Over Availability of Materials	291	10%	513	17%	1,072	36%	777	26%	358	12%	3,011
Over Policies in Work Group	482	16%	594	20%	991	33%	644	21%	299	10%	3,010
Over Layout/Design Workstation	394	13%	336	11%	588	20%	658	22%	1,036	34%	3,012

**Exhibit C-26b**

**Frequency Distribution of the Components of the  
Job Control Scale, Crystal Mall**

How Much Influence Do You Have in the Following Areas:	Very Little		Little		A Moderate Amount		Much		Very Much		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Over Amount of Work You Do	70	16%	78	17%	153	34%	90	20%	56	13%	447
Over Availability of Materials	95	21%	115	26%	142	32%	69	16%	24	5%	445
Over Policies in Work Group	99	22%	108	24%	134	30%	71	16%	32	7%	444
Over Layout/Design Workstation	61	14%	52	12%	106	24%	100	22%	126	28%	445

**Exhibit C-26c**

**Frequency Distribution of the Components of the  
Job Control Scale, Fairchild Building**

How Much Influence Do You Have in the Following Areas:	Very Little		Little		A Moderate Amount		Much		Very Much		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Over Amount of Work You Do	74	19%	74	19%	143	36%	70	18%	34	9%	395
Over Availability of Materials	40	10%	86	22%	136	34%	101	26%	32	8%	395
Over Policies in Work Group	68	17%	88	22%	137	35%	71	18%	31	8%	395
Over Layout/Design Workstation	69	18%	52	13%	61	15%	93	24%	119	30%	394

# Resp. - Number of Employees Responding.  
% Resp. - Percentage of Employees Responding.  
Reference: Part IV, question 5.

**Exhibit C-27a**  
**Frequency Distribution of the Components of the**  
**Quantitative Workload Scale, Waterside Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Required to Work Very Fast	127	4%	501	17%	997	33%	932	31%	475	16%	3,032
Required to Work Very Hard	111	4%	309	10%	755	25%	1,129	37%	729	24%	3,033
Little Time to Get Things Done	272	9%	404	13%	943	31%	828	27%	573	19%	3,020
Often Have Lot to Do	81	3%	258	9%	616	20%	1,082	36%	990	33%	3,027

**Exhibit C-27b**  
**Frequency Distribution of the Components of the**  
**Quantitative Workload Scale, Crystal Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Required to Work Very Fast	18	4%	98	22%	143	32%	121	27%	66	15%	446
Required to Work Very Hard	19	4%	51	11%	126	28%	146	33%	105	23%	447
Little Time to Get Things Done	45	10%	86	19%	112	25%	119	27%	83	19%	445
Often Have Lot to Do	9	2%	43	10%	75	17%	147	33%	173	39%	447

**Exhibit C-27c**  
**Frequency Distribution of the Components of the**  
**Quantitative Workload Scale, Fairchild Building**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Required to Work Very Fast	18	5%	68	17%	117	29%	121	30%	75	19%	399
Required to Work Very Hard	14	4%	43	11%	107	27%	117	29%	117	29%	398
Little Time to Get Things Done	34	9%	69	17%	112	28%	108	27%	77	19%	400
Often Have Lot to Do	11	3%	25	6%	71	18%	137	34%	155	39%	399

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part IV, questions 6.a through 6.d.

**Exhibit C-28a**

**Frequency Distribution of the Components of the Underutilization of Abilities Scale, Waterside Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Use Skills Learned in School	364	12%	490	16%	769	25%	855	28%	544	18%	3,022
Allowed to do Things You do Best	319	11%	392	13%	851	28%	1,035	34%	421	14%	3,018
Use Skills from Past Experience	252	8%	378	13%	661	22%	1,031	34%	697	23%	3,019

**Exhibit C-28b**

**Frequency Distribution of the Components of the Underutilization of Abilities Scale, Crystal Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Use Skills Learned in School	55	12%	76	17%	100	22%	129	29%	86	19%	446
Allowed to do Things You do Best	51	11%	72	16%	122	27%	141	32%	60	13%	446
Use Skills from Past Experience	44	10%	74	17%	92	21%	138	31%	99	22%	447

**Exhibit C-28c**

**Frequency Distribution of the Components of the Underutilization of Abilities Scale, Fairchild Building**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Use Skills Learned in School	52	13%	65	16%	102	26%	113	29%	64	16%	396
Allowed to do Things You do Best	41	10%	57	15%	128	33%	116	30%	51	13%	393
Use Skills from Past Experience	28	7%	52	13%	97	24%	118	30%	102	26%	397

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part IV, questions 6.e through 6.g.

**Exhibit C-29a**  
**Frequency Distribution of the Components of the**  
**Role Ambiguity Scale, Waterside Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Clear on Job Responsibilities	109	4%	223	7%	487	16%	1,262	42%	941	31%	3,022
Predict what Others Expect of You	136	5%	261	9%	601	20%	1,347	45%	677	22%	3,022
Work Objectives Well Defined	208	7%	370	12%	832	28%	1,137	38%	469	16%	3,016
Clear on Others Expectations of You	162	5%	294	10%	710	24%	1,254	42%	592	20%	3,012

**Exhibit C-29b**  
**Frequency Distribution of the Components of the**  
**Role Ambiguity Scale, Crystal Mall**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Clear on Job Responsibilities	12	3%	32	7%	60	13%	199	45%	143	32%	446
Predict what Others Expect of You	21	5%	31	7%	88	20%	209	47%	98	22%	447
Work Objectives Well Defined	28	6%	40	9%	109	24%	195	44%	75	17%	447
Clear on Others Expectations of You	25	6%	37	8%	96	21%	197	44%	92	21%	447

**Exhibit C-29c**  
**Frequency Distribution of the Components of the**  
**Role Ambiguity Scale, Fairchild Building**

	Rarely		Occasionally		Sometimes		Fairly Often		Very Often		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	# Resp.	% Resp.	
Clear on Job Responsibilities	15	4%	32	8%	55	14%	169	43%	126	32%	397
Predict what Others Expect of You	20	5%	35	9%	92	23%	164	41%	87	22%	398
Work Objectives Well Defined	19	5%	49	12%	93	23%	179	45%	58	15%	398
Clear on Others Expectations of You	20	5%	36	9%	92	23%	171	43%	79	20%	398

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part IV, questions 6.h through 6.k.

**Exhibit C-30a: Frequency Distribution of the Components of the External Stress Scale – WATERSIDE MALL**

	NO		YES		TOTAL RESPONDING
	Number	Percent	Number	Percent	
Children at Home	1,644	55%	1,365	45%	3,009
Major Responsibility for Childcare	2,250	75%	767	25%	3,017
Major Housecleaning Responsibilities	1,026	34%	1,988	66%	3,014
Regular Care for Elderly Person	2,858	94%	172	6%	3,030
Taking Courses Toward Degree/Diploma	2,692	89%	332	11%	3,024
Regular Commitment Outside Job	2,125	71%	888	29%	3,013

**Exhibit C-30b: Frequency Distribution of the Components of the External Stress Scale – CRYSTAL MALL**

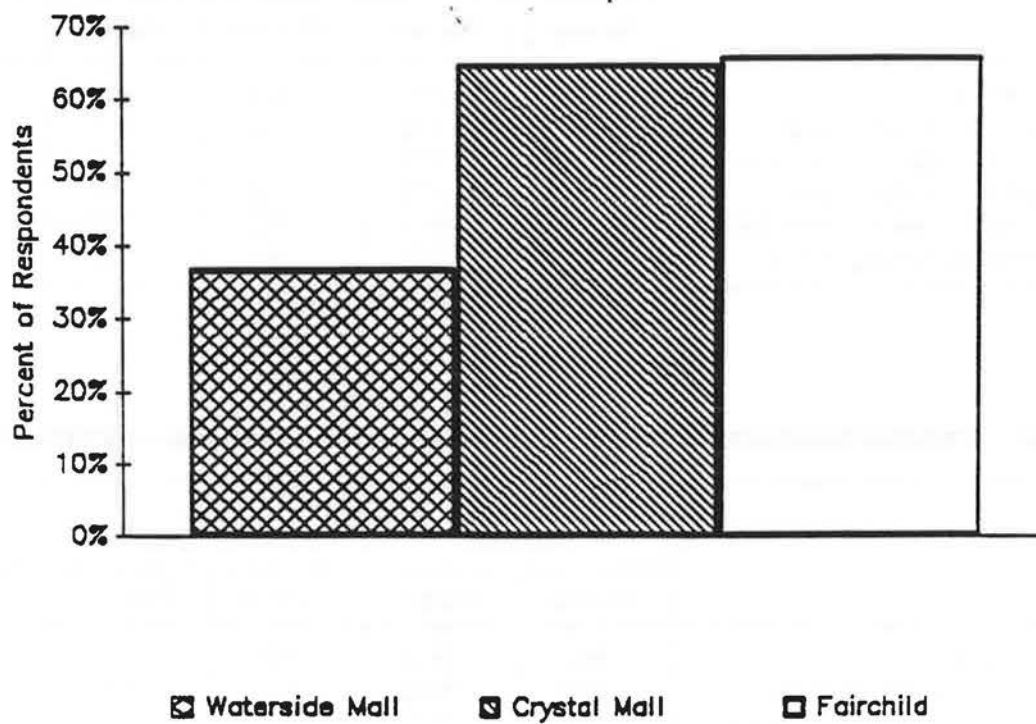
	NO		YES		TOTAL RESPONDING
	Number	Percent	Number	Percent	
Children at Home	245	55%	198	45%	443
Major Responsibility for Childcare	329	74%	113	26%	442
Major Housecleaning Responsibilities	169	38%	273	62%	442
Regular Care for Elderly Person	414	93%	30	7%	444
Taking Courses Toward Degree/Diploma	405	91%	40	9%	445
Regular Commitment Outside Job	295	66%	150	34%	445

**Exhibit C-30c: Frequency Distribution of the Components of the External Stress Scale – FAIRCHILD BUILDING**

	NO		YES		TOTAL RESPONDING
	Number	Percent	Number	Percent	
Children at Home	215	53%	189	47%	404
Major Responsibility for Childcare	302	75%	102	25%	404
Major Housecleaning Responsibilities	139	34%	265	66%	404
Regular Care for Elderly Person	386	96%	18	4%	404
Taking Courses Toward Degree/Diploma	367	91%	35	9%	402
Regular Commitment Outside Job	285	71%	117	29%	402

Reference: Part IV, Question 7.

**Exhibit C-31: Window at Workstation**



Reference: Part III, Question 6.

**Exhibit C-32a**  
**Types of Furniture, Equipment and Changes**  
**Within 15 Feet of Workstation, Waterside Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Metal Desk	1,703	60%	1,138	40%	2,841
Wood or Composition Desk	579	20%	2,349	80%	2,928
Metal Bookshelves or Bookcases	1,185	41%	1,717	59%	2,902
Wood or Composition Bookcases	882	31%	1,970	69%	2,852
File Cabinet(s)	575	19%	2,385	81%	2,960
Other Metal Furniture	1,411	51%	1,348	49%	2,759
Other Wood Furniture	662	23%	2,197	77%	2,859
Fabric-covered Partitions	1,557	55%	1,260	45%	2,817
Portable Humidifier	2,577	96%	121	4%	2,698
Laser Printer	1,671	59%	1,147	41%	2,818
Photocopy Machine	2,323	85%	401	15%	2,724
Live Plants	1,366	48%	1,473	52%	2,839
Carpeting	45	1%	3,000	99%	3,045
New Carpeting	2,295	80%	562	20%	2,857
New Drapes/Curtains	2,717	96%	105	4%	2,822
New Furniture	1,582	55%	1,282	45%	2,864
New Equipment	951	33%	1,941	67%	2,892
Walls Painted	2,159	76%	692	24%	2,851
Rearranged Walls	2,289	81%	549	19%	2,838
New/Continuing Water Leaks	2,501	85%	433	15%	2,934

# Resp. - Number of Employees Responding.  
 % Resp. - Percentage of Employees Responding.  
 Reference: Part I, questions 7, 8, 11 and 12.



**Exhibit C-32b**

**Types of Furniture, Equipment and Changes  
Within 15 Feet of Workstation, Crystal Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Metal Desk	251	63%	146	37%	397
Wood or Composition Desk	46	11%	380	89%	426
Metal Bookshelves or Bookcases	125	30%	295	70%	420
Wood or Composition Bookcases	146	37%	247	63%	393
File Cabinet(s)	52	12%	383	88%	435
Other Metal Furniture	180	47%	204	53%	384
Other Wood Furniture	106	26%	303	74%	409
Fabric-covered Partitions	215	53%	187	47%	402
Portable Humidifier	353	93%	28	7%	381
Laser Printer	291	75%	95	25%	386
Photocopy Machine	323	85%	56	15%	379
Live Plants	219	54%	186	46%	405
Carpeting	9	2%	434	98%	443
New Carpeting	371	92%	34	8%	405
New Drapes/Curtains	372	92%	34	8%	406
New Furniture	276	67%	133	33%	409
New Equipment	189	46%	221	54%	410
Walls Painted	326	81%	77	19%	403
Rearranged Walls	349	87%	51	13%	400
New/Continuing Water Leaks	388	93%	30	7%	418

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part I, questions 7, 8, 11 and 12.

**Exhibit C-32c**

**Types of Furniture, Equipment and Changes  
Within 15 Feet of Workstation, Fairchild Building**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Metal Desk	166	43%	218	57%	384
Wood or Composition Desk	136	37%	234	63%	370
Metal Bookshelves or Bookcases	175	46%	204	54%	379
Wood or Composition Bookcases	156	42%	212	58%	368
File Cabinet(s)	111	29%	275	71%	386
Other Metal Furniture	166	45%	201	55%	367
Other Wood Furniture	127	35%	241	65%	368
Fabric-covered Partitions	67	17%	326	83%	393
Portable Humidifier	338	97%	10	3%	348
Laser Printer	210	57%	157	43%	367
Photocopy Machine	283	81%	68	19%	351
Live Plants	194	52%	180	48%	374
Carpeting	3	1%	356	99%	359
New Carpeting	326	85%	57	15%	383
New Drapes/Curtains	337	89%	43	11%	380
New Furniture	193	50%	194	50%	387
New Equipment	112	28%	281	72%	393
Walls Painted	340	90%	38	10%	378
Rearranged Walls	272	71%	110	29%	382
New/Continuing Water Leaks	356	91%	35	9%	391

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part I, questions 7, 8, 11 and 12.

**Exhibit C-33a****Items Used Regularly at Workstation, Last Year,  
Waterside Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Portable Fan	1,430	52%	1,300	48%	2,730
Portable Air Filter	2,524	97%	84	3%	2,608
Portable Heater	2,067	78%	596	22%	2,663
Desk Lamp	1,457	54%	1,256	46%	2,713

**Exhibit C-33b****Items Used Regularly at Workstation, Last Year,  
Crystal Mall**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Portable Fan	211	55%	170	45%	381
Portable Air Filter	341	93%	24	7%	365
Portable Heater	356	97%	10	3%	366
Desk Lamp	219	58%	157	42%	376

**Exhibit C-33c****Items Used Regularly at Workstation, Last Year,  
Fairchild Building**

	No		Yes		Total Responding
	# Resp.	% Resp.	# Resp.	% Resp.	
Portable Fan	227	64%	130	36%	357
Portable Air Filter	337	97%	9	3%	346
Portable Heater	319	92%	28	8%	347
Desk Lamp	198	56%	158	44%	356

# Resp. - Number of Employees Responding.

% Resp. - Percentage of Employees Responding.

Reference: Part I, question 10.

**Exhibit C-34: History and Characterization of Respondents' Workplace at EPA Headquarters Buildings**

	WATERSIDE MALL		CRYSTAL MALL		FAIRCHILD	
	Mean	Median	Mean	Median	Mean	Median
Years of Service with EPA Ref: Ques. I.2	8.4 years	6.3 years	10.1 years	10.0 years	7.4 years	4.1 years
Years Working in Building Ref: Ques. I.3.a	6.9	4.6	6.3	5.2	3.5	1.8
Years at Current Workstation Ref: Ques. I.4.a	2.5	1.2	3.1	2.0	2.0	1.0

Hours/Week in Building Ref: Ques. I.3.b	41.5 hours	40.0 hours	41.1 hours	40.0 hours	40.8 hours	40.0 hours
Hours/Day at Workstation Ref: Ques. I.4.b	6.8	7.0	6.7	7.0	7.0	7.0
Hours/Day with Computer Ref: Ques. I.9.a	2.9	2.0	3.1	2.0	3.5	3.0
Hours/Day with Photocopy Mach. Ref: Ques. I.9.b	1.1	1.0	1.1	1.0	1.1	1.0
Hours/Day with Photographic Developing/Processing Ref: Ques. I.9.c	0.1	0.0	0.0	0.0	0.1	0.0
Hours/Day with Printing Processing Ref: Ques. I.9.d	0.1	0.0	0.0	0.0	0.1	0.0
Hours/Day with Other Chemicals Ref: Ques. I.9.e	0.3	0.0	0.3	0.0	0.3	0.0

**Exhibit C-35a**

**Summary of Responding Employees Years of Service  
and Characterization of Workstation, Waterside Mall**

	Minimum	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile	Maximum	Total Responding
Years of Service with EPA Ref.: Ques. 1.2	0.2	0.2	2.2	6.4	12.0	18.3	38.8	2,836
Years Working in Building Ref.: Ques. 1.3.a	0.0	0.0	1.9	4.6	10.0	16.0	19.0	2,770
Hours/Week in Building Ref.: Ques. 1.3.b	2.0	24.0	40.0	40.0	45.0	50.0	77.0	3,070
Years at Current Workstation Ref.: Ques. 1.4.a	0.0	0.0	0.0	1.2	2.1	5.0	19.0	2,053
Hours/Day at Workstation Ref.: Ques. 1.4.b	0.0	4.0	6.0	7.0	8.0	9.0	12.0	3,062
Hours/Day with Computer Ref.: Ques. 1.9.a	0.0	0.0	1.0	2.0	4.0	7.0	12.0	2,870
Hours/Day with Photocopy Machine Ref.: Ques. 1.9.b	0.0	0.0	1.0	1.0	1.0	2.0	12.0	2,806
Hours/Day with Photographic Developing/Processing Ref.: Ques. 1.9.c	0.0	0.0	0.0	0.0	0.0	0.0	8.0	2,004
Hours/Day with Printing Processing Ref.: Ques. 1.9.d	0.0	0.0	0.0	0.0	0.0	0.0	9.0	2,009
Hours/Day with Other Chemicals Ref.: Ques. 1.9.e	0.0	0.0	0.0	0.0	0.0	1.0	9.0	2,144

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Exhibit C-35b

Summary of Responding Employees Years of Service  
and Characterization of Workstation, Crystal Mall

	Minimum	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile	Maximum	Total Responding
Years of Service with EPA Ref.: Ques. 1.2	0.6	0.6	3.8	10.0	14.7	19.0	34.0	422
Years Working in Building Ref.: Ques. 1.3.a	0.6	0.6	2.3	5.8	8.8	12.2	19.0	413
Hours/Week in Building Ref.: Ques. 1.3.b	8.0	24.0	40.0	40.0	45.0	50.0	65.0	448
Years at Current Workstation Ref.: Ques. 1.4.a	0.3	0.3	0.4	2.0	3.0	7.0	12.0	340
Hours/Day at Workstation Ref.: Ques. 1.4.b	0.0	3.0	6.0	7.0	8.0	9.0	10.0	441
Hours/Day with Computer Ref.: Ques. 1.9.a	0.0	0.0	1.0	2.0	4.0	7.0	10.0	415
Hours/Day with Photocopy Machine Ref.: Ques. 1.9.b	0.0	0.0	1.0	1.0	1.0	2.0	12.0	406
Hours/Day with Photographic Developing/Processing Ref.: Ques. 1.9.c	0.0	0.0	0.0	0.0	0.0	0.0	1.0	258
Hours/Day with Printing Processing Ref.: Ques. 1.9.d	0.0	0.0	0.0	0.0	0.0	0.0	2.0	258
Hours/Day with Other Chemicals Ref.: Ques. 1.9.e	0.0	0.0	0.0	0.0	0.0	1.0	5.0	258

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Exhibit C-35c

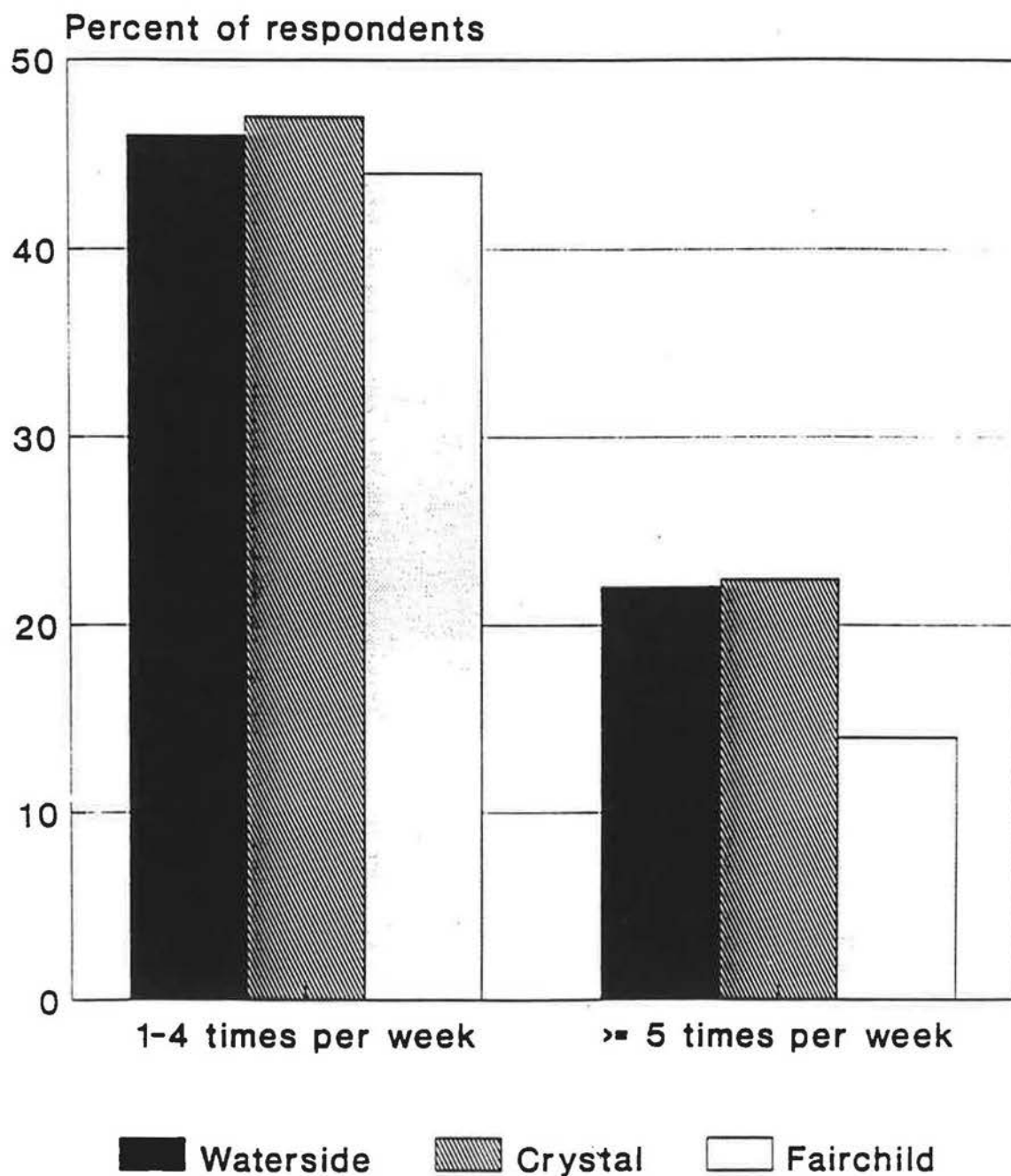
Summary of Responding Employees Years of Service  
and Characterization of Workstation, Fairchild Building

	Minimum	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile	Maximum	Total Responding
Years of Service with EPA Ref.: Ques. 1.2	0.3	0.3	1.7	4.1	10.0	18.0	33.0	357
Years Working in Building Ref.: Ques. 1.3.a	0.3	0.3	1.0	1.8	4.0	9.0	11.0	327
Hours/Week in Building Ref.: Ques. 1.3.b	4.0	20.0	40.0	40.0	45.0	52.0	66.0	407
Years at Current Workstation Ref.: Ques. 1.4.a	0.2	0.2	0.2	1.0	2.0	4.0	9.0	274
Hours/Day at Workstation Ref.: Ques. 1.4.b	0.0	4.0	6.0	7.0	8.0	9.0	10.0	403
Hours/Day with Computer Ref.: Ques. 1.9.a	0.0	0.0	1.0	3.0	5.0	8.0	10.0	386
Hours/Day with Photocopy Machine Ref.: Ques. 1.9.b	0.0	0.0	1.0	1.0	1.0	2.0	8.0	371
Hours/Day with Photographic Developing/Processing Ref.: Ques. 1.9.c	0.0	0.0	0.0	0.0	0.0	0.0	8.0	258
Hours/Day with Printing Processing Ref.: Ques. 1.9.d	0.0	0.0	0.0	0.0	0.0	0.0	5.0	258
Hours/Day with Other Chemicals Ref.: Ques. 1.9.e	0.0	0.0	0.0	0.0	0.0	1.0	5.0	273

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Exhibit C-36

# FRESH AIR BREAKS



Reference: Part III, question 9b









INDOOR AIR QUALITY AND WORK  
ENVIRONMENT STUDY

EPA HEADQUARTERS BUILDINGS

SUPPLEMENT TO VOLUME 1:

ADDITIONAL EMPLOYEE ADVERSE HEALTH EFFECTS  
INFORMATION

NOVEMBER 20, 1989

NATIONAL FEDERATION OF FEDERAL EMPLOYEES  
LOCAL 2050

AMERICAN FEDERATION OF GOVERNMENT EMPLOYEES  
LOCAL 3331



**SUPPLEMENTARY INFORMATION RELATED TO  
THE INDOOR AIR QUALITY ASSESSMENT OF EPA HEADQUARTERS**

A three volume report on the indoor air quality at headquarters, U.S. Environmental Protection Agency has been undertaken. It attempts to be a thorough and comprehensive study of the "perceived and actual" quality of the indoor air environment at EPA Headquarters buildings. As of mid-November, 1989, only Volume I has been completed. Volume I is a report on an employee health survey conducted in February, 1989.

The unions believe that to make the three-volume study as useful to the public as possible, to more completely reflect employees' views on the state of air quality at EPA headquarters, to make known the full extent and severity of injuries to employees, and to promote effective and timely action by EPA management on its indoor air problems, all available information on the incident which prompted the three-volume study in the first place (installation of certain new carpet and attendant employee injuries) should be conveniently packaged and published forthwith. The unions' preferred approach was to include the material contained here as Appendix D to Volume I. This did not prove possible, and this Supplement is therefore being co-produced with Volume I as a companion document.

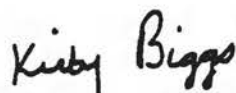
The unions believe that this Supplement is necessary because Volume I reports only on employee responses to the health survey questions, and therefore does not adequately address the most serious injuries suffered by EPA employees over the period October, 1987 through the Summer of 1989--induction of multiple chemical sensitivity. Further, other important information, including medical/professional opinions as to the significance of employees' health status is not included in Volume I. The unions believe that waiting for six or more months for this information to be published in subsequent Volumes of the report is not in the best interest of EPA, its employees or the general public (many of whom suffer from afflictions mimicking those of EPA employees).

The Supplement includes an analysis of data gathered by Local 2050, National Federation of Federal Employees and by Mr. Mark Ennen, an industrial hygienist who interviewed employees during the Winter/Spring of 1988. This analysis is in the form of a paper titled, "Carpet/4-Phenylcyclohexene Toxicity: The EPA Headquarters Case", presented before the Society for Risk Analysis, October 30, 1989. Also included are documents relating to petitions sent by employees to EPA management, letters from public health

professionals commenting on the implications of Volume I and on the indoor air quality at EPA Headquarters, and narratives from 18 employees, most of whom suffered induction of multiple chemical sensitivity at EPA Headquarters following exposure to new carpet fumes from October, 1987 through Summer, 1988.



Bob Carton, Ph.D., President  
NFFE Local 2050



Kirby Biggs, Steward  
Health & Safety  
AFGE Local 3331

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MARK E. BRADLEY, M.D., M.P.H.

OCCUPATIONAL MEDICINE

9316 FALLS BRIDGE LANE

POTOMAC, MARYLAND 20884

U S A

(301) 299-8826

June 25, 1989

The Honorable William K. Reilly  
Administrator  
Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460

Dear Mr. Reilly:

I am a physician whose specialty is occupational medicine. From mid-November, 1988, until the end of May, 1989, I worked as a consultant physician at the EPA Health Unit. I am writing to you, because my previous attempts to raise management concerns have been ignored.

During the period that I worked at the EPA, I interviewed and examined approximately 60 of your employees who work at the EPA headquarters. I have very serious concerns about the health and well-being of these individuals, and many others who I did not examine. The purpose of this letter is to share these concerns with you, and provide a first-hand, third party view of the building related illnesses, which are occurring at your facility.

During the six and a half month period that I was a consultant at the EPA Health Unit, at least 80% of the individuals who I examined, had bona fide medical problems, which I believe are caused by working at the Waterside Mall complex. Fifty to sixty percent of these folks had symptoms and physical findings which were typical of a "Tight Building Syndrome", that is to say eye and throat irritation, headaches, and so forth. Some of these people were severely affected. Thirty to forty percent of the patients that I examined had symptoms and findings of airway hyperreactivity which can be considered to be a form of occupational asthma. Ten percent of patients had evidence of allergic alveolitis, an inflammatory reaction in the alveoli and bronchioles of the lung resulting from an immune interaction between inhaled organic particles, circulating antibodies and sensitized lymphocytes. This condition can be progressive, leading to progressive pulmonary impairment and death. ( You will note that these percentages total more than 80%. The reason for this is that a fair number of these patients had more than one process ongoing.)

I am certain that during the period of time that I was seeing patients at the EPA Health Unit, that I saw only a small fraction of the people who are potentially, adversely affected by the environment of the Waterside Mall complex. Based on my experience with problems of this nature, as well as patients reports of colleagues who were having difficulties, I estimate that 10 to 20% of the personnel at your headquarters are experiencing untoward health effects. I frankly consider that there is a major public health situation at this location, and that this is not being dealt with in a timely, positive and responsible fashion. What is particularly unfortunate is that this is a totally remedial situation.

On a monthly basis, I submitted reports which noted these findings and expressed my concerns. I made multiple recommendations for investigative and remedial actions. I got absolutely no response to these reports at all, and as far as I can determine no action of any sort has been taken to rectify this situation.

I have enclosed copies of my reports and other correspondence during this period, as well as a copy of my resume which describes my background and experience in occupational medicine.

I strongly recommend the following:

1. There are multiple instances of defective design and maintenance of the air handling and conditioning systems in the Waterside Mall, which may well be contributing to indoor air quality problems. These need to be rectified.
2. The epidemiological data that Westat has collected should be analyzed as soon as possible to determine those areas which are particular "hot spots".
3. A large scale pulmonary function screening program should be implemented to detect affected individuals.
4. Simply increasing the ventilation to provide maximum fresh air exchange would be immediately beneficial.
5. This situation does warrant consultation by a physician experienced in building related illnesses. Consideration should be given to requesting assistance from NIOSH and/or CDC. Alternatively, Dr. Kay Price is internationally recognized as an authority in this area. Dr. Price is currently Director of Occupational Medicine at the National Jewish Center for Immunological and Respiratory Diseases in Denver.

I will be happy to meet with you and your staff to discuss this situation. I recognize that this is an extremely sensitive

-3-

and emotional situation, and feel that you are in the best position to address it.

Sincerely Yours,

*Mark Bradley*

Mark E. Bradley, M.D.

MEDICAL IN CONFIDENCE

February 21, 1989

Dr. Juan Pozo-Olano  
Health Services International, Inc.  
3101 South Street, N.W.  
Washington, D.C. 20007

Dear Dr. Pozo-Olano:

This letter follows up on our recent conversation regarding my occupational medical work at the Health Unit of the Environmental Protection Agency. Since mid-November, 1988, I have interviewed and examined between 35 and 40 patients at this facility. The majority of these individuals have symptoms and signs which are quite typical of a "building related illness". A few of these individuals clearly have affective disorders, such as depression, while a few others have situational adjustment disorders in which there is job "burn-out" or employee - supervisor conflict. I have unearthed a surprising amount of non-occupationally related medical conditions, such as anemia, prolapsed mitral valves, diabetes, hypercholesterolemia, carpal tunnel syndromes, etc.

One extremely disturbing finding has emerged in the course of this work. Two (and possibly a third patient) of the individuals that I have examined have shown moderate restrictive defects on their pulmonary function studies. I would point out that the likelihood of finding restrictive lung disease in 5 to 10% of the general population is very remote. Certainly, there are non-occupational disorders such as sarcoidosis that can produce restrictive lung disease. However, my concern is that this may indeed represent an occupational pulmonary disorder in these individuals. Hypersensitivity pneumonitis can cause the sort of symptoms and findings that these patients have. The etiology agent of hypersensitivity pneumonitis is frequently biological, but it can be caused by exposure to certain chemicals such as isocyanate, phthalic anhydride, etc. The fact is that the potential antigens for hypersensitivity pneumonitis is extremely large, and our knowledge of which chemicals can cause this phenomenon is quite small. For example, I have seen identical findings in individuals who have been exposed to chemicals in workplace situations as diverse as ice cream plants and research laboratories. With prolonged exposure to these substances and persistent chronic inflammation, the patient can, and often is, left with permanent and debilitating lung disease.

MEDICAL IN CONFIDENCE

My work with these individuals has thus far consisted of a evaluation of their disorders within the scope of the contract that Health Services International, Inc. has with the EPA. This has included physical examinations, chest x-rays, pulmonary function studies, serum precipitins, and other appropriate blood work. I have notified Ms. Rachel Gregory of my findings and suspicions, and have recommended that mold and fungi cultures of the work space of one individual be obtained and that an inspection of the air conditioning systems to that area be performed.

I strongly recommend that these individuals receive a more comprehensive evaluation of their pulmonary status than can be provided at the health unit. This should include examination by a pulmonologist with extensive pulmonary function testing as well as other tests that would be indicated. As luck would have it, none of these individuals has health insurance, and as two are AARP employees, there is some question regarding what organization would be responsible for medical evaluation and treatment under "Workman's Compensation", if these were determined to be occupationally related disorders. I have two concerns about this dilemma. The first relates to the health of these folks. The second, to the impact that this would have on the EPA if these are occupationally related. The "building related illness" employees at EPA are quite militant and vocal, and the potential for fanning the flames into a major conflagration is great.

This information is, of course, extremely sensitive, and should be handled in confidence. Please ponder this. I look forward to discussing this with you in further detail.

Sincerely Yours,

Mark E. Bradley, M.D.



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

JUN 16 1988

OFFICE OF  
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Additional Comments on OHSS Indoor Air Quality Questionnaire

FROM: Kent Anderson  
Ventilation Committee Representative  
Land Disposal Branch, OSW (WH-565E)

TO: David Weitzman, Director  
Office of Health and Safety Staff

In addition to my earlier comments on the questionnaire, I have received additional concerns from our female employees. They are particularly concerned over the importance of identifying any long range chronic health effects as a result of our working environment. Any acute health effects which we are beginning to document may serve as an indicator to an even greater long term health problem.

Specifically, several women, never making the connection before, have identified a history of abnormal menstrual cycles and/or gynecologic complications, after it was disclosed that there were detectable concentrations of a chemical being emitted from the carpets that affected both enzyme and estrogen levels. The Office of Health and Safety should design and conduct a thorough epidemiologic cohort study on health effects of women in the EPA work environment. Although the problems that women are having are something that has not been openly discussed, several women are experiencing menstrual abnormalities. A cohort study would not only document the incidence rate of these problems, but would also determine whether the women in EPA have a higher rate of problems than the rest of the working female population. Given that EPA's female population is, on average, a young population, in their reproductive years, it is of great concern. Also, since this population is not in the menopausal or pre-menopausal age group, this would not be a significant confounding variable in the study.

Just in one OSW branch along, every women has had either abnormal growth in fibroids (which are very sensitive to estrogen levels), abnormal uncontrollable cycles (which are dictated and controlled by estrogen levels), or an inability

to conceive (also influenced by estrogen levels). This is surprising, but raises concern, considering that the majority of people showing severe acute adverse health effects are females.

There are several occupational physicians and epidemiologists who specialize in reproductive effects. There are scientists within the Agency itself that also could lend expertise. Please let me know if you are interested in pursuing such a study, since our Office can provide references for such an effort.

cc: Jack McGraw  
John Chamberlin  
Jim O'Leary





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

MAY 13 1988

MEMORANDUM

OFFICE OF  
SOLID WASTE AND EMERGENCY RESPONSE

SUBJECT: Indoor Air Problems at EPA Headquarters

FROM: Arthur Day, Acting Chief  
Land Disposal Branch

A handwritten signature in black ink, appearing to read "Arthur Day", written over the typed name.

TO: Joseph S. Carra, Director  
Waste Management Division

Numerous complaints have been voiced regarding the poor indoor air quality in the area of the second floor mall, where the majority of OSWER employees are located. Resulting health effects range in severity and include headaches; burning eyes, nose, throat, and skin; nausea; persistent cough; respiratory infections; sinusitis; dizzy spells; difficulty breathing; disorientation and confusion; numbness of limbs; and constricting larynx.

At least two EPA employees from OSW have been hospitalized due to severe reactions to contaminants which are being circulated throughout the ventilation system at Waterside Mall. At least four OSW employees have been advised by their physicians not to return to Waterside Mall as a result of building related illness.

Lack of adequate ventilation in the EPA building and offgassing of chemicals from new carpet, wall board, dividers, etc., may be resulting in relatively high levels of VOCs which are not being effectively drawn out of office space, and once drawn out, are being recirculated. Some employees have apparently been sensitized to concentrations in the air and are now experiencing reactions to very low concentrations.

For the past two years complaints have been directed to persons in the Occupational Health and Safety Staff (OHSS) who are responsible for the protection of the health and safety of EPA employees and to the Facilities Office at EPA that is responsible for building maintenance. Both of these offices have been unresponsive to comments and hostile to many.

The agreement that was made on May 2, 1988, to discontinue putting in new carpeting was a step in the right direction. It seems fairly obvious that one of the contributing factors to this problem is that much of Waterside Mall is improperly ventilated, and building-related illnesses due to carpet installation have primarily taken place in locations of Waterside Mall which have less circulation. Even though a strong correlation exists between air circulation and illnesses related to the renovation, the facilities office has begun to paint the walls in many of the areas that have poor airflow. Employees have recently complained of headaches, lightheadedness, and nausea in newly painted areas. I would therefore suggest that all renovation at Waterside Mall, including painting be stopped immediately.

Another outcome of the May 2nd decision to stop laying new carpeting was the decision to discontinue monitoring efforts which were initiated by OSWER in an attempt to identify which chemical(s) and concentration levels were causing employees to become ill. I believe that monitoring efforts should be continued whether or not carpet is being laid. Under no circumstances should any renovation activities take place (e.g., carpeting or painting) in the future without monitoring before, during, and after such activities.

Another issue which I would like to address concerns the methodology used to monitor indoor air. On April 21, Mark Ennen who is a private contractor "industrial hygienist" (hired by EPA's Occupational Health and Safety Staff) set up monitoring equipment to sample formaldehyde in Room 2817 of the second floor mall. The monitoring was done in response to a request that OSW had made subsequent to two severe reactions by OSW employees to new carpeting in adjacent offices. OSW representatives had requested that a special effort be made to air out and monitor Room 2817. On Wednesday, April 20, fans were brought into Room 2817 and the ventilation system in this area which is normally shut off after working hours was run all night. On Thursday, April 21, formaldehyde monitoring equipment was set up by Mark Ennen, directly below one fan in Room 2817.

I would like to point out that: (1) formaldehyde monitoring equipment should not be set up beneath fans if accurate readings are to be obtained, (2) such behavior hardly gives much credibility to any industrial hygienist, and (3) a certification program exists in the industrial hygiene profession which generally involves a degree in industrial hygiene, at least two years of experience in the field, and passing a rigorous examination. Mr. Ennen, to my knowledge, is not a certified industrial hygienist (CIH). Persons in the industrial hygiene field who are not certified would seldom work independently without a CIH. I am appalled that the EPA's Occupational Health

and Safety Staff would hire an industrial hygienist who is not a CIH to investigate this problem, which obviously has such important consequences.

The Occupational Health and Safety Staff have acted irresponsibly on numerous occasions. OSW employees who resided in Room 2627 (which has been reassigned a new number and is now 2631), from December 1986 to October 1987, experienced many health problems, especially during the time between June and August 1987. Such health problems included laryngitis, sore throat, persistent cough, headaches, dizzy spells, fluid in lungs, difficulty breathing, and general fatigue. Upon calling Tony Brown of OHSS, OSW staff were told that OHSS recognized that an indoor air problem existed and that they were documenting all complaints. OSW staff in Room 2627 proceeded to document all illnesses that they believed might be related to poor indoor air quality in this area. All complaints were first articulated over the phone, and the written documentation was sent directly to Tony Brown of OHSS. On November 30, 1987, staff from OSW sent Tony Brown as well as other members of OHSS a copy of a memo which documents apparent building related illnesses experienced by OSW employees in Room 2627.

The result of this documentation was that no action was taken and OHSS representatives, including Tony Brown, flatly denied ever receiving any complaints or memo on this subject. Hundreds of complaints have been articulated to OHSS over the past two years regarding poor indoor air quality at Waterside Mall. OHSS has not responded to any of these complaints until:

- 1) several OSW employees experienced severe reactions to toxic chemicals which are being circulated in the ventilation system, and
- 2) two articles appeared in the Washington Times which explained the indoor air problem at Waterside Mall.

The resulting reaction by OHSS was to merely discontinue laying new carpet at Waterside Mall "for the time being."

I believe that such irresponsible and negligent behavior on the part of OHSS is intolerable and has caused much suffering by EPA employees. I would suggest that the federal program office of OSHA be called in to oversee and evaluate the competency of OHSS to carry out their mission.

In summary, I would suggest that the following be done in an attempt to remedy the existing indoor air problem at EPA:

- 1) all renovation be discontinued at Waterside Mall,

- 2) air quality and quantity monitoring be continued and standard monitoring protocol be used for all monitoring activities, with work to be performed by an independent party experienced in indoor air investigations,
- 3) a certified industrial hygienist (CIH) or team of CIHs be hired to investigate this problem,
- 4) the OSHA Office of Federal Agency Programs be called in to evaluate EPA's Occupational Health and Safety Staff,
- 5) immediate renovations be made in the ventilation system along at least the 2800 corridor,
- 6) serious consideration be given to removal of recently installed carpeting, and
- 7) serious and immediate determination be made as to whether certain employees are at exceptional risk (e.g., females taking estrogen), with a corresponding decision on whether such persons should be temporarily excused from attendance in the Mall.

I would be pleased to provide further information as needed.

cc: Kent Anderson  
Bob Dellinger  
Jim O'Leary  
Mike Flynn  
Joanne Bahura



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

AUG 4 1988

MEMORANDUM

SUBJECT: Petition on Ventilation

FROM: Myra Cypser, OAR

*Myra Cypser*

Mark Antell, OAR

*Mark Antell*

Vanessa Musgrave, OSWER

*Vanessa Musgrave*

TO: Lee M. Thomas  
Administrator

Attached is a petition to you signed by 567 employees. It asks you to "provide a healthy indoor environment for EPA employees and to establish a comprehensive indoor air program for all the Headquarters buildings that can be a model for the entire country". Note that 19 employees wrote that they disagreed with a portion of the petition but signed anyway.

Employees continue to be concerned about indoor air/ventilation issues in Headquarters buildings. We hope that you will give this matter further attention. We would be happy to meet with you to discuss the petition and we look forward to seeing your response to it.



TESTIMONY OF  
BOBBIE LIVELY-DIEBOLD  
BEFORE THE  
UNITED STATES HOUSE OF REPRESENTATIVES  
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY  
SUBCOMMITTEE ON NATURAL RESOURCES,  
AGRICULTURE RESEARCH, AND ENVIRONMENT  
JULY 20, 1988  
ON THE  
INDOOR AIR QUALITY ACT OF 1980 (H.R. 1530)

MY NAME IS BOBBIE LIVELY-DIEBOLD. I AM EMPLOYED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY IN WASHINGTON, D.C. I AM APPEARING HERE TODAY NOT ON BEHALF OF MY AGENCY, BUT BECAUSE I AM AMONG THOSE WHOSE HEALTH AND LIFE HAS BEEN RADICALLY AFFECTED BY THE INDOOR AIR AT EPA HEADQUARTERS. MY TESTIMONY INCLUDES INFORMATION PRESENTED BY MY COLLEAGUE, STEVE SHAPIRO, BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS IN MAY.

LONGSTANDING PROBLEMS RELATING TO THE AIR QUALITY AT WATERSIDE MALL, EPA'S CENTRAL HEADQUARTERS SITE, CAME TO A HEAD LAST YEAR WHEN CLUSTERS OF PEOPLE IN SEVERAL LOCATIONS WHERE NEW CARPET HAD BEEN LAID BECAME ILL. WHEN THIS WAS REPORTED TO EPA FACILITIES MANAGEMENT AT THE BEGINNING OF 1988, NO ACTION OF ANY TYPE WAS TAKEN TO IDENTIFY AND REMOVE THE SUSPECTED SOURCES OF POLLUTION. BUILDING RENOVATIONS CONTINUED AND ADDITIONAL EMPLOYEES BECAME ILL. WITHIN ONE BRANCH IN A DIVISION OF THE OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE (OSWER), EIGHT OUT OF 25 PEOPLE WERE AFFECTED. FOUR HAD TO STOP WORKING AT THE BUILDING AND FOUR HAD SIGNIFICANT HEALTH

PROBLEMS BUT CONTINUED TO WORK INSIDE. IN ANOTHER DIVISION OF OSWER WITH ABOUT 62 PEOPLE, AT LEAST NINE WERE AFFECTED, FIVE BEVERELY, ONE SOMEWHAT LESS, AND AT LEAST THREE HAD SIGNIFICANT HEALTH PROBLEMS.

BY MAY, THERE WERE SEVEN OF US IN THE MALL AND EAST TOWER AREAS WHO HAD BECOME SO SEVERELY AFFECTED THAT OUR DOCTORS ADVISED US TO TRY TO ARRANGE WORKING OUT OF OUR HOMES OR AT SOME OTHER LOCATION. A LARGER GROUP OF PEOPLE WHO WERE NOT QUITE AS SEVERELY AFFECTED STRUGGLED TO CONTINUE TO WORK INSIDE THE BUILDING. NONE OF THE SUSPECTED SOURCES OF THIS OUTBREAK OF ILLNESS, INCLUDING THE NEW CARPETING, WAS EVER REMOVED. SUBSEQUENTLY, AT LEAST SEVEN OTHERS HAVE HAD TO STOP WORKING AT WATERSIDE.

PROGRAM MANAGERS, PEOPLE SICK FROM INDOOR AIR, AND VARIOUS HEALTH PROFESSIONALS, AND UNION OFFICIALS HAVE HAD A GENERALLY FRUSTRATING TIME GETTING EPA TO ACT RESPONSIBLY, RESPONSIVELY, AND COMPETENTLY.

IT IS IRONIC THAT, IN RESPONSE TO PREVIOUS INCIDENTS OF ILLNESS RELATED TO NEW CARPET, EPA A FEW MONTHS EARLIER INCLUDED IN ITS EXCELLENT INTERNAL INDOOR AIR POLICY (APPENDIX B) PROVISIONS FOR PREVENTING JUST SUCH AN OUTBREAK.

Employees will not be exposed to chemicals at levels known to be toxic or acutely irritating to the eyes, nose, or throat or cause other physical ill to employees...

New carpeting shall be shampooed before the space is occupied unless it has been properly aired out or has been shown to not emit chemicals which cause health reactions to occupants. If vapors from carpeting or

furniture result in a health reaction, the affected employees should be allowed to work at a temporary location until the problem is solved...

I BELIEVE THAT IF EPA'S ADMINISTRATIVE MANAGEMENT HAD INITIALLY TAKEN THE PROBLEM SERIOUSLY AND TAKEN IMMEDIATE ACTION UNDER THE TERMS OF ITS OWN INDOOR AIR POLICY, WE COULD HAVE BEEN SPARED THE TRAUMA AND DISTRESS OF THIS ILLNESS.

THE OVERALL AIR QUALITY PROBLEMS AT WATERSIDE ARE MANY AND COMPLEX. EVEN WITH THE MANY RESOURCES AT ITS COMMAND, EPA HAS AT BEST HAD A DIFFICULT TIME TRYING TO DEAL WITH THESE PROBLEMS AND WITH THE EPIDEMIC IN THE BUILDING OVER THE PAST YEAR. WHEN EPA RECENTLY ATTEMPTED TO CONDUCT AN AIR MONITORING SURVEY, THE BUILDING OWNER REPORTEDLY INCREASED THE VENTILATION RATES BY A FACTOR OF TWO OR THREE DURING THE TIME OF THE SURVEY.

WE HAVE YET TO LEARN THE NUMBER OF PEOPLE WHOSE HEALTH HAS BEEN AFFECTED BY RENOVATIONS DONE AT WATERSIDE OVER THE PAST YEAR AND A HALF, BUT MINIMUM NUMBERS INCLUDE:

AT LEAST 8 EPA EMPLOYEES WHO HAVE LEFT EPA FOR HEALTH REASONS ARISING FROM INDOOR AIR POLLUTION

AT LEAST ELEVEN EPA EMPLOYEES WHO ARE AT HOME OR IN ALTERNATIVE WORK SPACE

OVER 100 EPA EMPLOYEES WHO HAVE GONE TO THE HEALTH UNIT OVER EFFECTS FROM INDOOR AIR POLLUTION

## 78 EPA EMPLOYEES WHO REPORTED ILLNESS TO THE AGENCY'S HEALTH AND SAFETY INVESTIGATOR AT THE HEIGHT OF THE CARPET CRISIS

BUT THIS IS JUST THE TIP OF THE ICEBERG. THERE ARE THOSE WHO ARE NOT AWARE THAT IT IS THE INDOOR AIR AT EPA THAT IS AFFECTING THEIR HEALTH AND PRODUCTIVITY. THROUGHOUT THE WORK WEEK THESE PEOPLE POP BUDAFEDS AND GO THROUGH A BOX OF KLEENEX. THERE ARE A GOOD MANY WHOSE HEALTH AND PRODUCTIVITY HAD BEEN AFFECTED FOR A TIME OR STILL ARE AFFECTED, BUT NOT TO THE EXTENT THAT THEY WERE COMPELLED TO STAY OUT OF WATERSIDE. THERE ARE THOSE WHO HAVE LEFT EPA WITHOUT FORMALLY REPORTING THAT THEY LEFT DUE TO ILLNESS. SOME FOUND UPON LEAVING THE BUILDING THAT THEIR HEALTH PROBLEMS DISAPPEARED. AND FOR ALL THE ABOVE SITUATIONS, THERE ARE NUMEROUS CONTRACT EMPLOYEES, RETIREES WORKING FOR EPA THROUGH THE AMERICAN ASSOCIATION OF RETIRED PERSONS, STAY-IN-SCHOOLS (HIGH SCHOOL AND COLLEGE STUDENTS), CONTRACT BUILDING SERVICE AND SECURITY STAFF, AND THE WORKERS LAYING THE CARPET WHO HAVE NEVER EVEN BEEN COUNTED.

THE RANGE OF BUILDING-RELATED SYMPTOMS INCLUDES A VARIETY OF MODERATE AND ACUTE RESPIRATORY PROBLEMS; HEADACHE; SORE THROAT; BURNING EYES, LUNGS, AND SKIN; RASHES; FATIGUE; LARYNGITIS; CLUMSINESS; DISORIENTATION; LOSS OF BALANCE; NAUSEA; NUMBNESS IN EXTREMITIES AND FACE; AND DIFFICULTY WITH MENTAL TASKS. REPRODUCTIVE EFFECTS ARE A CONCERN AS WELL. THE OCCUPATIONAL HEALTH PHYSICIANS SOME OF US HAVE SEEN SAY THE MOST COMMON PROBLEMS INCLUDE UPPER AND LOWER RESPIRATORY IRRITATION, INTOXICATION-TYPE SYNDROME, OCCUPATIONAL ASTHMA, AND CHRONIC HYPERSENSITIVITY PNEUMONITIS. THE EFFECTS ON THE CENTRAL NERVOUS SYSTEM EXPERIENCED BY MANY OF US DON'T LEND



THEMSELVES TO READY DIAGNOSIS. SOME OF THE PEOPLE WHO HAVE BEEN AFFECTED, BUT NOT TO THE POINT WHERE THEY HAVE BEEN COMPELLED TO LEAVE THE BUILDING, EITHER SEE NO PHYSICIAN AT ALL OR SEE A FAMILY

DOCTOR OR ALLERGIST WHO IS NOT FAMILIAR WITH OCCUPATIONAL OR ENVIRONMENTAL HEALTH.

SOME ARE ABLE TO FUNCTION IN MOST BUILDINGS OTHER THAN WATERSIDE. SOME HAVE NO PROBLEMS VISITING HAZARDOUS WASTE SITES FOR A WEEK AT A TIME, BUT BECOME ILL AFTER 15 MINUTES INSIDE WATERSIDE. OTHERS HAVE BECOME PROGRESSIVELY REACTIVE TO TRACE AMOUNTS OF THE MYRIAD VOLATILE ORGANIC COMPOUNDS IN OUR ENVIRONMENT WHICH MOST PEOPLE TAKE FOR GRANTED. THERE ARE THOSE WHO BUFFER WHEN EXPOSED TO THE PRESUMED BIOLOGICAL AGENTS IN THE AIR AT WATERSIDE, WHEN EXPOSED TO AREAS THAT WERE RENOVATED OR CARPETED DURING THE LAST FEW YEARS, OR WHEN THE VENTILATION SYSTEM IS NOT OPERATING NORMALLY OR NOT OPERATING AT ALL -- BUT WHO RECOVER OVER TIME.

APPENDIX I CONTAINS PERSONAL HISTORIES REPRESENTATIVE OF THOSE PEOPLE WHOSE HEALTH AND LIVES HAVE BEEN AFFECTED BY THE AIR QUALITY AT EPA HEADQUARTERS.

#### WHAT HAPPENED TO US

THERE ARE PEOPLE WITH ALLERGIES WHO MAY BE AT SPECIAL RISK TO INDOOR AIR QUALITY PROBLEMS, AND THIS RISK SHOULD BE CONSIDERED IN THE FORMULATION OF INDOOR AIR QUALITY STANDARDS. BUT ILLNESS FROM INDOOR AIR DOES NOT RESPECT AGE OR HEALTH. MOST OF US WHO CAN NO LONGER

WORK INSIDE WATERSIDE HAVE NOT HAD A HISTORY OF ALLERGIES. OUR GROUP INCLUDES PEOPLE IN THEIR PRIME, IN THEIR TWENTIES, EX-JOGGERS, AN EX-MARATHON RUNNER, A KARATE BLACK BELT, AND OTHERS WHO WERE IN

GOOD HEALTH BEFORE THEY WERE AFFECTED. THERE ARE INDIVIDUAL CHEMICALS OR COMBINATIONS OF CHEMICALS FOUND IN OFFICES AND OFFICE BUILDINGS - NOT ALL NECESSARILY COME FROM CARPET AND RENOVATION MATERIALS - WHICH CAN APPARENTLY PRODUCE SHORT- AND LONG-TERM HEALTH EFFECTS. ALTHOUGH OUR ILLNESS WAS PREVENTABLE, NONE OF US, EXCEPT FOR SOME OF THOSE WHO HAVE BECOME ILL THIS YEAR, WERE WARNED.

WHEN YOU FIRST FEEL ILL, YOU TRY TO DENY IT BECAUSE YOU DONT WANT TO INTERRUPT YOUR WORK AND YOUR HOME LIFE. YOU WONDER WHAT KIND OF BUG YOU HAVE - SOME OF US THOUGHT WE MIGHT HAVE HAD MONO, AIDS, OR LYME DISEASE. SOME OF THOSE AFFECTED REACHED A TURNING POINT WHERE THEY IMPROVED OR THEY STABILIZED TO WHERE THEY COULD FUNCTION AT A REDUCED LEVEL INSIDE WATERSIDE. OTHERS GOT WORSE. MOST OF US WHO CAN NO LONGER GO INTO WATERSIDE, HAVE NOT BECOME LESS REACTIVE. SOME HAVE BECOME PROGRESSIVELY MORE REACTIVE. I'M SPEAKING OF REACTIONS TO PARTS PER MILLION, BILLION, OR EVEN TRILLION OF SUBSTANCES OR COMBINATIONS OF SUBSTANCES WHERE REACTIONS ARE NORMALLY ASSOCIATED WITH PARTS PER THOUSAND.

HOME LIFE AND OTHER ACTIVITIES. IS IT SENSIBLE TO IGNORE THE SYMPTOMS - YOU OFTEN REACT IN BUILDINGS TO THINGS YOU CAN'T EVEN SMELL OR YOU SMELL BUT DON'T RECOGNIZE - AND ENDURE THE PHYSICAL MISERY AND TEMPORARY MENTAL DYSFUNCTION? OR IS IT SENSIBLE TO DROP OUT OF YOUR LIFE AND LIVE AS A RECLUSE AT HOME OR IN A REMOTE AREA TO AVOID THE VOLATILE CHEMICALS OF THE 20TH CENTURY? THERE ARE NO GOOD ANSWERS TO THIS DILEMMA.

#### SUBSEQUENT DEVELOPMENTS

WHEN THE CARPET CRISIS BROKE IN MAY 1988, A DIVISION OF THE OFFICE OF SOLID WASTE AND EMERGENCY RESPONSE HAD BEEN SCHEDULED TO MOVE INTO NEWLY-RENOVATED SPACE IN THE MALL AREA. THE MOVE WAS HELD UP PENDING AN EPA MANAGEMENT DECISION ON THE PROBLEM BATCH OF CARPET. THAT SUMMER, EPA'S ADMINISTRATIVE MANAGEMENT DECIDED TO GO AHEAD WITH THE OSWER MOVE ON A VOLUNTARY BASIS. EMPLOYEES WERE ANXIOUS TO LEAVE THEIR LOW-CEILING, OVERCROWDED, TEMPORARY OFFICES. THESE TEMPORARY OFFICES HAD ASBESTOS CRUMBLING FROM THE CEILINGS AND WERE INFESTED WITH MICE AND ROACHES. UNDER THESE CIRCUMSTANCES, MOST ELECTED TO TAKE THEIR CHANCES IN THE NEWLY-CARPETED SPACE. THE VACATED TEMPORARY WORK SPACE WAS THEN REMODELLED DURING WORKING HOURS IN SUCH A MANNER THAT FOR SEVERAL WEEKS ASBESTOS FELL ON EMPLOYEES REMAINING IN THAT SECTION OF THE BUILDING. SEVERAL PEOPLE BROKE OUT WITH SEVERE SKIN RASHES FROM THE ADHESIVE USED IN LAYING FLOOR TILE.

THE IRONY THAT SERIOUS INDOOR AIR QUALITY PROBLEMS HIT EPA HEADQUARTERS OF ALL PLACES IS LOST ON FEW PEOPLE. WHAT IS DOUBLY IRONIC IS THAT THERE HAVE BEEN REPEATED INDOOR AIR QUALITY PROBLEMS EXPERIENCED WITHIN THE DIVISION RESPONSIBLE FOR EPA'S INTERNAL ENVIRONMENTAL HEALTH AND SAFETY. WHEN THIS AGENCY PROGRAM MOVED OUT OF WATERSIDE TO THE HEADQUARTERS FACILITY IN THE FAIRCHILD BUILDING IN SUMMER 1987, SOME STAFF DEVELOPED RESPIRATORY AND OTHER PROBLEMS THEY ASSOCIATED WITH NEW CARPET IN THE BUILDING. THEN THIS PAST APRIL, THIS DIVISION MOVED BACK TO WATERSIDE, AGAIN INTO NEWLY-RENOVATED SPACE. AGAIN, MANY PEOPLE IN THIS DIVISION HAVE DEVELOPED RESPIRATORY SYMPTOMS. ONE PERSON WHO HAS DEVELOPED PROBLEMS WITH BREATHING HAS DECIDED TO STICK IT OUT IN HER NEW OFFICE. ANOTHER PERSON WHOSE SKIN BROKE OUT IN RED SPLOTCHES WHENEVER SHE ENTERED HER DIVISION'S NEW SPACE WAS RELOCATED TO AN OFFICE REMOVED FROM HER DIVISION. SHE HAS SINCE LEFT EPA.

IN APRIL 1988, EPA IMPOSED A MORATORIUM AT HEADQUARTERS ON FURTHER LAYING OF THE BATCH OF CARPET ASSOCIATED WITH THE OUTBREAK OF ILLNESS. BUT THIS PAST WINTER EPA STATED THAT IT WOULD INSTALL SOME OF THE REMAINING CARPET AT EPA'S LABS IN EDISON, NEW JERSEY, AND RESEARCH TRIANGLE PARK, NORTH CAROLINA.

THIS PAST APRIL, THE BUILDING OWNER AT WATERSIDE ALLOWED ANOTHER TENANT, THE GENERAL ACCOUNTING OFFICE, TO INSTALL NEW CARPET BELIEVED TO EMIT "4-PC", A STYRENE SUBSTANCE SUSPECTED IN THE OUTBREAK OF ILLNESS AT EPA. VAPORS FROM THIS CARPET GO INTO EPA'S HALLWAYS. EMPLOYEES ARE CONCERNED, BUT EPA SAYS THIS IS A MATTER BEYOND ITS JURISDICTION.

VARIOUS STUDIES RELATING TO THE CARPET AND INDOOR AIR QUALITY AT EPA HEADQUARTERS HAVE BEEN INITIATED. A MODIFICATION IS PLANNED TO THE AIR SYSTEM IN THE LIBRARY AREA, ALTHOUGH EPA'S OFFICE OF ADMINISTRATION REPORTED THAT THIS QUARTER OF A MILLION DOLLAR PROJECT WAS DESIGNED WITHOUT CONSIDERATION OF AIR QUALITY STANDARDS.

DESPITE THE POOR AIR QUALITY AT WATERSIDE AND CONTINUING INCIDENCES OF EMPLOYEES BECOMING ILL, THE OFFICE OF ADMINISTRATION ANNOUNCED ON MAY 23 THAT BUILDING RENOVATIONS WOULD BE DONE DURING NORMAL WORK HOURS IN ORDER TO CONTAIN COSTS. EMPLOYEES WERE INCREDULOUS. THE UNIONS RESPONDED WITH A REQUEST TO BARGAIN OVER THIS ISSUE. THE OFFICE OF ADMINISTRATION HAS AGREED TO BARGAIN, BUT REITERATED TWO WEEKS AGO THAT IT STILL PLANNED TO CONDUCT SOME RENOVATION ACTIVITIES INVOLVING THE RELEASE OF TOXICS DURING NORMAL WORK HOURS.

ON JUNE 18, THERE WAS A RELEASE OF XYLENE FUMES IN THE EAST TOWER WHEN A CONTRACTOR APPLIED A SEALANT CONTAINING XYLENE ON THE ROOF NEAR AN AIR INTAKE DAMPER. THE OFFICE OF ADMINISTRATION REPORTED THAT SEVEN EMPLOYEES BECAME VISIBLY ILL. AT LEAST ONE OF THESE PERSONS HAS HAD SERIOUS CONTINUING PROBLEMS INSIDE THE BUILDING EVER SINCE. STAFF FROM THE AGENCY'S INTERNAL ENVIRONMENTAL HEALTH AND SAFETY DIVISION RESPONDED TO THIS INCIDENT BY GOING AROUND THE EAST TOWER WITHOUT RESPIRATORY PROTECTION OR SAMPLING/ANALYTICAL EQUIPMENT, SNIFFING WITH THEIR NOSES TO TRACK DOWN THE FUMES. OTHER STAFF FROM ENVIRONMENTAL HEALTH AND SAFETY WERE ABLE TO OBTAIN A MATERIAL SAFETY DATA SHEET WITHIN AN HOUR AND A HALF, WHICH IDENTIFIED THE FUMES AS XYLENE. THE OFFICE OF

ADMINISTRATION REPORTED THAT WITHIN FOUR HOURS IT WAS ABLE TO COME TO A DECISION ABOUT THE XYLENE, WHICH WAS NOT TO EVACUATE THE EAST TOWER.

A GROUP OF SERIOUSLY AFFECTED EMPLOYEES REQUESTED LAST MARCH TO MEET WITH THE AGENCY'S TOP ADMINISTRATIVE MANAGEMENT TO DISCUSS ENSURING COMPETENT, RESPONSIBLE, AND RESPONSIVE MANAGEMENT FOR DEALING WITH THE MANY PROBLEMS ARISING FROM INDOOR AIR POLLUTION AT HEADQUARTERS. THE ADMINISTRATION NEVER RESPONDED TO THIS REQUEST.

THE PRESSING AIR QUALITY PROBLEMS AT HEADQUARTERS ARE FAR FROM BEING MASTERED. IT WILL TAKE COMMITTED ACTION ON THE PART OF THE ADMINISTRATION TO ENABLE THE REINTEGRATION INTO WATERSIDE OF AFFECTED EMPLOYEES WHO HAD TO STOP WORKING INSIDE THE BUILDING. LAST WEEK, WE WROTE TO THE NEW ADMINISTRATOR ABOUT THE CONTINUING PROBLEMS ARISING FROM AIR QUALITY AT HEADQUARTERS AND ASKED THAT HE DESIGNATE A PERSON IN HIS IMMEDIATE OFFICE TO TAKE CHARGE.

APPENDIX III CONTAINS A MEMORANDUM FROM WITHIN EPA'S INDOOR AIR DIVISION DOCUMENTING SOME OF THE LONGSTANDING PROBLEMS WITH THE HEADQUARTERS VENTILATION SYSTEM STILL AWAITING SOLUTION BY EPA'S ADMINISTRATIVE MANAGEMENT. THIS REPORT COMES OUT OF A BROADER EFFORT TO CHARACTERIZE THE DESIGN AND OPERATIONAL PROBLEMS WITH THE VENTILATION SYSTEM AT WATERSIDE.

SOME OF THOSE MOST AFFECTED BY THESE ILLNESSES ARE AT HOME. SOME ARE WITHOUT WORK. APPROXIMATELY TEN PEOPLE HAVE BEEN RELOCATED SINCE NOVEMBER TO WORK SPACE IN AN APARTMENT BUILDING

## THE LONG ROAD OF DECISION-MAKING

WHEN SOMEONE WHO WORKS AT EPA COMES TO UNDERSTAND THAT HE OR SHE IS BECOMING ILL FROM EXPOSURE TO A CHEMICAL OR A COMBINATION OF CHEMICALS IN THE AIR, WORKER, SUPERVISORS, MANAGEMENT, AND TREATING PHYSICIANS MAY EMBARK ON A LONG ROAD OF DECISION-MAKING. AS A WORKER, YOU HAVE TO CHOOSE WHETHER TO TOUGH-OUT FEELING SICK IN THE HOPE THAT IT WILL PASS, ALTHOUGH NOT ATTENDING TO YOUR ILLNESS MAY RESULT IN WORSE ILLNESS; OR TRY TO TAKE CARE OF YOURSELF, ALTHOUGH THIS MAY RESULT IN DISRUPTIONS TO YOUR WORK AND ULTIMATELY YOUR CAREER, YOUR ORGANIZATION, YOUR PERSONAL WELFARE, AND YOUR FAMILY'S WELFARE. A COMMON CHOICE IS TO DENY THAT YOU SHOULD DO ANYTHING ABOUT THE PROBLEM.

SUPERVISORS FACE ISSUES OF HOW TO KEEP A WORKER INTEGRATED IN THE ORGANIZATION. VARIOUS SUPERVISORS HAVE SAID THEY ARE AT A LOSS OVER WHAT TO DO WITH SOMEONE WHO IS UNABLE TO WORK AT FULL CAPACITY OR WHO CAN'T COME INTO THE OFFICE, ATTEND MEETINGS, AND WORK WITH OFFICE DOCUMENTS AND EQUIPMENT. WHAT ARE A SECRETARY AND SUPERVISOR TO DO WHEN THE SECRETARY CAN'T BE IN THE OFFICE TO HANDLE PAPERWORK AND TELEPHONES AND HELP OTHERS AS NEEDED?

WHEN SOMEONE CAN'T BE ON LOCATION TO CONTRIBUTE TO A PROJECT, YOU CAN TRY WAYS TO GET AROUND THIS WITH TELECOMMUNICATIONS - SPEAKER PHONES, FAXING, AND MODEMS - BUT OFTEN THIS IS INCONVENIENT, INEFFICIENT, DISRUPTIVE, OR UNWORKABLE.

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YOU GO TO A DOCTOR FOR ADVICE AND BOTH OF YOU ARE FACED WITH A DILEMMA: DO YOU CONTINUE AT WORK AND RISK GETTING SICKER WITH AN ILL-DEFINED ILLNESS THAT NO ONE UNDERSTANDS? DO YOU WITHDRAW FROM THE WORKPLACE AND STOP GOING TO OTHER PLACES WHERE LOW EXPOSURES CAN AFFECT YOU, IN THE HOPE THAT YOU MIGHT RECOVER FROM BOTH THE EFFECTS OF THE SICKNESS AND FROM THE GENERAL CONDITION? THERE IS NO WAY TO PREDICT WHETHER OVER TIME YOU WILL RECOVER FROM THIS CONDITION. DO YOU GIVE UP YOUR JOB TO TRY OUT ANOTHER WORKPLACE ON A GAMBLE THAT IT TOO WON'T CAUSE YOU TO BE SICK? DO YOU AVOID GOING TO NEW PLACES BECAUSE THE AIR MIGHT MAKE YOU SICK?

WE EXCHANGE EXPERIENCES AMONG OURSELVES ABOUT OTHER OFFICE BUILDINGS, HOTELS, STORES, MALLS, INDOOR MARKETS, SCHOOLS, DOCTOR'S OFFICES, HOSPITALS AND CLINICS, RESTAURANTS, PLACES OF WORSHIP, GREENHOUSES, AND OTHER PLACES THAT AFFECT US TO MINIMIZE THE RUSSIAN ROULETTE EFFECT ON US OF BREATHING INDOOR AIR. THIS IS SOMEWHAT HELPFUL, BUT WE ALL DON'T REACT TO THE SAME THINGS, TO THE SAME DEGREE, OR AT THE SAME RATE.

OUR LIVES ARE FULL OF SURPRISES. YOU WALK INTO A PLACE YOU THOUGHT SAFE, ONLY TO BE CAUGHT IN FUMES FROM PAINT, CLEANING AGENTS, PERFUME, NAIL POLISH, CIGARETTE SMOKE, COMMON TOLUENE/XYLENE MAGIC MARKERS, WHITE-OUT, NEW FURNITURE, ELECTRONIC EQUIPMENT AND JET INK PRINTERS, PLASTIC OBJECTS, PLASTIC WRAPPING, GLUE, MASTICS - THE LIST NEVER ENDS.

WHEN YOU GET A REACTION, THE EFFECTS ARE OFTEN NOT CONFINED TO WORK. THEY CAN STAY WITH YOU FOR DAYS OR WEEKS, AFFECTING YOUR

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NEAR THE EAST TOWER. OTHERS HAVE LEFT THEIR PROGRAMS AND EVEN THEIR CAREERS AT EPA. THOSE AFFECTED MOST SEVERELY INCLUDE SECRETARIES, PROFESSIONAL STAFF, AND SECTION AND BRANCH CHIEFS. AS A GROUP, SUPERVISORS WHO ARE AFFECTED SEEM MOST RELUCTANT OF ALL TO BE IDENTIFIED AS HAVING THESE PROBLEMS, BELIEVING THAT THIS CAN BE HIGHLY DETRIMENTAL TO THEIR CAREERS AS MANAGERS. THE PERSONAL HISTORIES IN APPENDIX I DOCUMENT SOME OF THE TRAUMA AND TURMOIL THESE ILLNESSES HAVE CAUSED IN OUR VOCATIONAL AND PERSONAL LIVES.

#### PERSONAL EXPERIENCES OF ROBBIE LIVELY-DIEBOLD

As the result of my personal commitment to the preservation of the natural and human environment, I identified the Environmental Protection Agency (EPA) as the place where my career efforts would be most effective. To me, employment by EPA was not just a job but the focus of my social concern. I pursued my career at EPA for eleven years both in Region V in Chicago, Illinois and at Headquarters in Washington, D.C. Although I experienced success in achieving protection of the environment, EPA was not successful in protecting me from its environment. As the result of having to perform my job in unsafe conditions, my health has been damaged, perhaps irreparably, my career potential has been destroyed, my life choices compressed to a very small sphere. I have been socially isolated, my ability to earn a living taken out of my control and I am dependent upon the decisions of the Department of Labor for income and payment of medical expenses. By August of this year I will no longer have a job. The Agency responsible for my condition may choose to no longer have any obligation toward making accommodations for my problem.

Exposures to indoor air pollution in poorly ventilated buildings such as Waterside Mall have turned a healthy, athletic person who jogged twenty miles a week, lifted weights and did aerobics into a person of limited activity. I can no longer jog due to lung pain and have difficulty breathing while doing light exercise or when exposed to low to moderate levels of

pollutants. In addition, I now react to products that are in common use, such as cleaning supplies, perfumed products, paints, solvents, petroleum-based compounds, cigarettes, and chemicals found on fabrics, such as formaldehyde. To achieve the clean environmental conditions I require to be reasonably comfortable and free from pain and reactions, I spend most of my time in a stripped room with two air filters and limit my excursions from home. I must wear a respirator to travel in a car and in buildings where I cannot avoid exposures. Every trip outside my home must be planned to avoid or limit exposures. These trips are spaced to keep my immune system from being overloaded. I avoid malls and shop mostly by catalog. I have very little social life since restaurants, theaters, and homes of friends often have intolerable levels of pollutants. My husband, a PhD. physicist must do the housework and assume many of my former responsibilities.

I have not been able to travel to see my children or to participate in milestone occasions in their lives. My grandson was almost two years old before I saw him. I must read the newspaper outdoors and wash my hands after each section to prevent becoming ill. All new magazines, books and certain photocopied documents must be aired out to allow solvents to off-gas before I can read them.

One of the most distressing consequences of my exposure is the change from being considered a valued, effective employee into one that is written off as "damaged goods", and considered

unable to "do the job". Some supervisors are at a loss on how to keep employees integrated into the organization while others do not even try. I face the dual problems of being unable to find a location where I can perform a job while protecting my health and also finding an employer without prejudice against a person with my health handicap.

My problems are the direct result of my exposures in EPA over two periods. The first was on January 20, 1988 and intermittently over the next several weeks. I experienced loss of voice, burning of my face, difficulty breathing, dizziness, loss of memory, mental confusion, facial rashes, and loss of ability to concentrate. After five weeks out of the building most symptoms disappeared. My doctor allowed me to return to work with the restrictions that I must be placed in an area without on-going renovations such as painting and carpet installation and with fresh air intake and ventilation that would meet standards established by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). I returned to work at the end of March, 1988 and was told that there was not an area within Waterside Mall that would meet ASHRAE standards. I had to work in an area where the rest of my section had been moved while our original area was remodeled. Although my supervisor assigned me tasks out of the building whenever possible, I again experienced reactions that escalated in severity. Within ten days after my return to work, all my symptoms, including neurological problems had returned. On

## RECOMMENDATIONS

THE BILL YOU ARE CONSIDERING IS A GOOD ONE. WHAT FOLLOWS ARE RECOMMENDATIONS FOR EMPHASIS OR INCLUSION.

### INDOOR AIR QUALITY

THERE IS A NEED FOR BETTER UNDERSTANDING OF THE RANGE OF INDOOR AIR CHEMICALS THAT CAN AFFECT PEOPLE, ESPECIALLY CHEMICALS IN COMBINATIONS, RATHER THAN JUST SINGLE CHEMICALS.

ALGORITHMS. PEOPLE WHO RUN BUILDINGS NEED TO BE TRAINED IN THE FUNDMENTS OF PUBLIC HEALTH AND NEED ALGORITHMS TO EVALUATE A BUILDING AND TO EVALUATE PROBLEM AREAS WITHIN A BUILDING.

AIR QUALITY STANDARDS. CONSENSUS STANDARDS FOR ACCEPTABLE INDOOR AIR QUALITY, SUCH AS ASHRAE, SHOULD BE REEVALUATED TO ACCOUNT FOR BUILDING RENOVATIONS, CARPETING, ELECTRONIC EQUIPMENT, AND BIOLOGICAL AGENTS; AND ADDRESS AIR QUALITY FOR ALL PERSONS - HEALTHY, SICK, ALLERGIC, AND CHEMICALLY HYPERSENSITIVE.

BUILDING CODES. BUILDING CODES SHOULD BE DEVELOPED TO INTEGRATE GOOD INDOOR AIR QUALITY PRINCIPLES.

### INDOOR AIR QUALITY AUTHORITY

AN INDOOR AIR QUALITY CERTIFICATION AUTHORITY SHOULD BE CREATED, SO THAT BUILDING BUYERS, RENTERS, OCCUPANTS, AND VISITORS CAN HAVE STANDARDIZED SITE-SPECIFIC INFORMATION ABOUT THE QUALITY OF AIR INSIDE PUBLIC, COMMERCIAL AND MULTI-TENANT RESIDENTIAL BUILDINGS.

### IDENTIFYING HAZARDS

TESTING. MANUFACTURERS OF CONSUMER PRODUCTS, SUCH AS BUILDING AND OFFICE PRODUCTS AND COSMETICS, CONTAINING VOLATILE ORGANIC MATERIALS, SHOULD TEST THESE MATERIALS UNDER A PROTOCOL INCORPORATING WORST-CASE CONDITIONS, SUCH AS IN AN UNVENTILATED CUBBYHOLE OFFICE. THIS WOULD BE COMPARABLE TO THE WAY BRIDGES ARE DESIGNED. RESULTS OF TESTS SHOULD BE ON FILE WITH EPA.

LABELLING. THE HAZARDS OF CHEMICALS USED IN BUILDING CONSTRUCTION AND RENOVATION AND MAINTENANCE, FURNISHINGS, OFFICE EQUIPMENT AND SUPPLIES, AND PERSONAL ITEMS SUCH AS NAIL POLISH, PERFUME/COLOGNE SHOULD BE LABELLED. PRODUCTS CONTAINING VOLATILE ORGANIC MATERIALS AND CARCINOGENS SHOULD LABEL ALL INGREDIENTS IN ORDER OF DECREASING CONCENTRATION. BUILDING MANAGERS, OCCUPANTS, AND VISITORS HAVE A RIGHT, NEED, AND RESPONSIBILITY TO KNOW AND ADDRESS THESE HAZARDS. INGREDIENT LISTING SHOULD ENCOURAGE REDUCED USE OF HARMFUL MATERIALS.

April 7, 1988 a carpet was installed in an adjacent corridor and I experienced anaphylactic shock that was more severe than in January. I was helped out of the building and on the advice of my doctor, have not reentered since. (Additional details of my exposure are in Appendix I, Personal History 85.) I now have not worked 16 months. Some of my symptoms cleared up after a few months but I began to react to many other low level exposures. It took months for my lung pain and neurological disorientation to become less severe. I was without normal use of my voice for seven months. Extensive speech therapy helped me to regain normal function although I lose my voice upon exposure to various pollutants.

I have not been offered any hope that I will ever return to my former level of health. There is little medical knowledge about the health problems resulting from indoor air pollution. The main medical treatment for my condition is avoidance, although others like myself often take multiple medications. Avoidance measures to protect my health are expensive and have varying degrees of success. For example, the existing fuel oil furnace in my house must be moved outside to prevent my recurrent reactions. It will cost at least seven thousand dollars. I have spent over one thousand dollars on air filters, none of which is covered by insurance. Although avoidance has its cost, the worst impact is not financial but the loss of the ability that most people take for granted - that of living a normal life. How will I be compensated for that loss?

I look normal. My handicap is not visible. But I am not alone. Conditions such as mine are becoming all too common. Presently, no individual is protected from the dangers of indoor air pollution. This could happen to anyone. People are being exposed in Federal agencies as well as the private sector. Visitors from other countries have been affected in our buildings. I have been contacted by people from all over the country with similar problems. I have not been able to resolve their problems nor my own. The problem of indoor air pollution that has adversely affected and continues to affect millions of people requires federal action such as set forth in this bill. Delay in its passage and implementation will increase the toll on people's lives, health, careers and financial livelihood. Delay will also increase costs to business and industry for health care, loss in productivity and disability payments. For these and other reasons in the submitted testimony I support this bill.



RIGHT TO KNOW. ALL NEED TO KNOW WHICH PRODUCTS CONTAIN CHEMICALS WHICH ALONE OR IN COMBINATION CAN MAKE PEOPLE ILL. SPECIAL EFFORT SHOULD BE MADE TO IDENTIFY CHEMICALS OR COMBINATIONS WHICH AT VERY LOW CONCENTRATIONS CAN PRODUCE ADVERSE HEALTH EFFECTS IN HEALTHY PEOPLE, IN CHEMICALLY HYPERSENSITIVE PEOPLE, AND IN CHILDREN. AIR SAMPLING IS A POOR SOLUTION FOR EVALUATING THESE HAZARDS. IT'S EXPENSIVE, IT'S IMPRACTICAL, AND SAMPLING AND ANALYTICAL METHODS FOR MANY CHEMICALS ARE NOT AVAILABLE. IN ADDITION, AIR SAMPLING DOESN'T ADDRESS CHEMICALS ACTING IN COMBINATION.

EPA SHOULD DESIGNATE PRODUCTS TO BE AVOIDED BY PEOPLE WITH CHEMICAL SENSITIVITIES. THIS DESIGNATION SHOULD BE INCLUDED ON PRODUCT LABELS.

BUILDING OCCUPANTS SHOULD BE GIVEN ADVANCE NOTIFICATION OF PESTICIDE USAGE.

#### CONTROLLING VOLATILES

VOLATILITY LIMITS SHOULD BE SET FOR CONSUMER PRODUCTS USED INDOORS. ADDITIONAL TESTING SHOULD BE REQUIRED FOR PRODUCTS CONTAINING ACUTELY TOXIC SUBSTANCES AND CARCINOGENS, JUST AS RESPONSIBLE MANUFACTURERS ALREADY DO OUT OF LIABILITY CONSIDERATIONS. THE REGULATION OF THESE PRODUCTS SHOULD BE MANDATED UNDER A STATUTORY TIME SCHEDULE.

#### CHEMICAL HYPERSENSITIVITY

AN INITIATIVE SHOULD BE UNDERTAKEN TO RESEARCH THE CAUSES, NATURE, INCIDENCE, TREATMENT, AND PREVENTION OF CHEMICAL HYPERSENSITIVITY.

#### BUILDING MANAGEMENT

AIR QUALITY ADVOCATES. PROGRAMS SHOULD BE DEVELOPED TO ESTABLISH AIR QUALITY ADVOCATES IN BUILDINGS. SUCH A PERSON SHOULD HAVE AUTHORITY TO CONTROL WHAT MATERIALS ARE INTRODUCED INTO A BUILDING BY ANYONE, INCLUDING OCCUPANTS AND VISITORS, AND TO DIRECT REMOVAL OF SOURCES OF POLLUTION.

OUTBREAKS OF ILLNESS. CRITERIA SHOULD BE DEVELOPED FOR AN APPROACH TO PREVENT, MONITOR, AND DEAL WITH INCIDENTS OF BUILDING-RELATED SICKNESS. THIS SHOULD INCLUDE MEDICAL TREATMENT, CAREER AND PERSONAL COUNSELLING FOR VICTIMS; AND CRITERIA UNDER WHICH BUILDING OWNERS SHOULD BE REQUIRED TO RESPOND TO PROTECT PEOPLE'S HEALTH.

CRIMINAL PENALTIES SHOULD BE IMPOSED WHEN NEGLIGENT OPERATION OF A BUILDING RESULTS IN SERIOUS BUILDING-RELATED ILLNESS.

#### HELPING VICTIMS

A FEDERAL PROGRAM SHOULD BE ESTABLISHED TO ADDRESS THE PERSONAL CONDITION OF THOSE WHO BECOME SICK FROM INDOOR AIR. SOME MAY BE IN

A POSITION TO GET COMPENSATION, OTHERS NOT. WHO SHOULD PAY FOR LOSSES OF INCOME AND OTHER EXPENSES AND HOW IS ONE TO RECOVER THESE LOSSES?

SPECIAL ADVOCACY, MEDICAL TREATMENT, FINANCIAL ASSISTANCE, AND VOCATIONAL REHABILITATION PROGRAMS SHOULD BE ESTABLISHED FOR SERIOUSLY AFFECTED PEOPLE. IT WILL BE NICE TO HAVE DEFINITIVE MEDICAL RESEARCH ON BUILDING-RELATED ILLNESSES AND CHEMICAL HYPERSENSITIVITY, BUT WE SHOULD NOT DEFER PROVIDING HELP TO THE GROWING NUMBER WHO ARE SUFFERING FROM THESE PROBLEMS.

#### BUILDING OCCUPANT BILL OF RIGHTS

A BILL OF RIGHTS SHOULD BE ENACTED FOR ALL BUILDING OCCUPANTS - HEALTHY, ALLERGIC, AND CHEMICALLY HYPERSENSITIVE.

#### APPENDIX I

#### PERSONAL HISTORIES

## HISTORY #1

I have been experiencing acute health effects including eye irritation, headaches, sore throat, dizziness, difficulty in concentrating, some periodic breathing difficulties, occasional nausea, and some neurological symptoms. I usually experience these symptoms within an hour of arriving at my work space. If I am able to be away from this space for some hours, the symptoms increasingly subside, although not totally. If I am on travel, I do not experience these symptoms at all after I have recovered from being in my space. These acute symptoms first appeared shortly after I moved to this space and have become exacerbated since the renovation of the SE273 suites. I have reported these symptoms to the EPA Health Clinic.

I believe the fact that I am at greater risk than some others in this space may potentially be because of my current health situation; I already have allergies to a number of different common substances. Discussions with those employees who are severely affected indicate that once hypersensitization occurs, it could become irreversible and that the more "minor" symptoms precede major onsets. I have no desire to be a victim of these larger problems.

### Chronicle of Past Health Problems

I have become alarmed by reports that Waterside Mall may be a "sick building" and that the area of the Mall we occupy may be worse than other parts of the Mall complex. I have long wondered if the building may be the source of these problems, and if my current problems with the area may be just an acute extension of a problem which has been developing over the last several years, exacerbated by the newly renovated space.

If the "sick building" theory is true, I have a deeper concern than just myself--my son is in day care in the bottom of the West Tower.

I moved to SE276 in January 1983. In mid-June 1983 I developed an intense irritation of the throat and began to get recurrent sinus infections. I went to several doctors who were unable to identify the source of the problem, finally ending with my current physician, who diagnosed the condition as allergic rhinitis, gave me a Rast test to determine allergies to the local ecology, then put me on weekly shots of allergy serum for pollens and inhalants. Before this time, I had never experienced any allergic reactions to even the most universal allergens such as poison ivy.

By mid-1985 my health was deteriorating badly. I was experiencing recurrent colds, sinus infections, coating of my tongue, repetitive gastrointestinal difficulties, and fatigue so severe that, even though it seemed completely impossible that I had contracted AIDS, I had myself tested (negative result).

My health reached a nadir around early-1986. I began visiting a MD/nutritionist at that point, who suggested I be tested for food allergies. I did so and discovered I had become allergic to a number of common food substances such as wheat, members of the nightshade family (white potatoes, bell peppers, eggplant, tomatoes), and a number of other substances. My existing but limited difficulty in processing cow's milk became very severe, including reactions to the amount of cream contained in the small 1/2 & 1/2 creamers used for coffee. I was placed on and still observe a rigid elimination diet, avoiding substances causing reactions. This diet has improved my health markedly, but I have not recovered completely, and may never.

I have also been tested for Epstein-Barr (low-medium titers), and metals. I have had Heidelberg tests, have had my blood tested for imbalances, and have undergone a number of other tests to try to find the source of the problem--all to no avail.

I have consulted my MD/nutritionist and my doctor of internal medicine on these matters and they both tell me I must consider the building as a possible source of these problems.

(May 26, 1988)

Subsequently, I was moved to several different rooms in Waterside as EPA restored the space I was occupying.

I moved out of Waterside in December 1988 and worked at home through February of this year. Since moving into EPA's alternative workspace, I have experienced limited reactions to the new workspace.

**HISTORY #2**

Following recarpeting at EPA, this person experienced central nervous system and respiratory symptoms, including bronchitis, burning lungs, headaches, dizziness, difficulty concentrating, numbness, and a clinically measurable decrease in nerve conduction velocity. Her physician told her not to reenter Waterside Mall. After leaving the building, she continued to experience these symptoms when exposed to relatively low levels of solvents such as those commonly found in office supplies, paint, home cleaning products.

She tried working at home, but these problems continued with other exposures. She interviewed for another job and did not suffer adverse health effects in the office where she was interviewed. She relocated at her own expense (\$4000).

Her new employer has a self-reporting disability procedure. She reported she needed special accommodations, was provided an air filter, and was allowed to crack open a window.

Even with these accommodations, she continued to get sick. Near her desk were two laser printers, a copy machine, and secretaries who used various office supplies, including white-out and carbonless paper. She got headaches almost everyday. There were personal computers throughout the office. She had acute health difficulties when copy machines were being repaired and when she attended meetings where special markers were used on chalkless boards.

After requesting further accommodations, she was repeatedly harassed by management. Her supervisor told her that doctors' letters documenting her condition were not enough to justify accommodations beyond the open window and air filter. The supervisor requested she release her medical records. She did so. She now has a handicap discrimination grievance pending. Her union has backed her up strongly.

Except for dermatitis, she had no previous allergies. She did not develop dermal problems at EPA. She has recently developed various food allergies.

**HISTORY #3**

I left Maine and began working at EPA, Waterside Mall, in April 1986. I had last been checked for pulmonary function by physicians in Maine. Results indicated normal range of vital capacity and pulmonary function. Good health -- ran marathons until injured in 1984.

I noticed respiratory problems, particularly during that first winter, 1986-1987. I often had flu-like problems, nasal congestion, constant need to clear throat. Pulmonary function tests revealed mild to moderate respiratory disease. I could not function without Proventil inhaler as bronchial dilator. By that time, I was working on the Sixth Floor of the East Tower.

During the summer of 1987 my problems worsened. Mold was growing on the carpet. The smell of mildew was pervasive. Shoes and briefcase left over a weekend turned green.

I had previously had a good attendance record, seldom using sick leave. I used every single day of sick leave I had, used annual leave, and had to borrow sick leave. My office mate, who was never sick before, was constantly sick. My branch chief, who did not previously have headache problems, got headaches.

I moved to Crystal Mall II to a stuffy interior office with poor ventilation. Still, I am now off Proventil except for occasional use. I have missed only one day of work in nine months, due to colds, flu. I lost some other time for dental surgery. I no longer need Sudafed to sleep at nights.

I am firmly convinced that Waterside Mall damaged my health. Yet I am not one to complain very much and you will not find my name among Agency statistics.

#### History #4

I was employed at EPA for three years and had been in excellent health prior to my illness. In early December 1987, I moved into newly renovated office space in EPA's third floor mall. I immediately smelled a strong chemical odor that nauseated me. Four days later, I began experiencing symptoms of severe sore throat, headaches, nausea, and burning eyes while in my office. These symptoms would decrease overnight but would reappear when I returned to the office the next day. Within a few weeks, I was also experiencing facial burning, extreme fatigue, coughing and chest pains, a chemical smell and taste in my nose and mouth, and a facial rash. Within the space of four months, my supervisor moved me to three locations within the EPA complex to try and relieve my symptoms. I would not have any reaction for a few days, and then the symptoms would reappear.

While this was happening at work, I was also having problems at home. My face burned in my kitchen, so I got rid of any chemicals in my apartment -- laundry detergent, cleaners, ammonia, etc. I had the pilot lights in my gas stove turned off. My in-laws installed new carpet in their home and I could not enter their house for four months because I experienced the same symptoms I had at work. I began to have symptoms while doing the simplest things, such as reading newspapers; walking to the grocery store; going into a smoky restaurant. If I went on a trip, I had trouble finding a hotel room where I did not react.

After five months in the EPA building, I tried working outside the building. I tried the D.C. public library next to EPA, but they had new rolls of carpet ready to be installed and I experienced the same symptoms. I tried working at several contractor's offices, but after a few days the symptoms would appear.

In May 1988, I went to see an occupational physician, underwent some pulmonary tests, and was diagnosed as having developed a syndrome of asthmatic bronchitis and upper respiratory irritation secondary to exposures to emissions from renovation and primarily from the new carpet applied at EPA. My doctor recommended that I leave the source of contamination (the EPA building) and take steroid inhalants to see if the asthmatic bronchitis would improve. I was out of work for four months during the summer.

After I left EPA, I tried to work at home and had my work files moved there, but I reacted to whatever small amount of chemical was still on the papers and files. I would also experience the symptoms for no apparent reason: once a group of sick EPA employees met with a Department of Labor staffer in the park next to the Russell Senate Office Building. After an hour I started experiencing all my symptoms. I never did find the cause, but my face broke out in welts and burned so badly that I had to apply ice packs to relieve the pain.

I eventually found another Federal job in the fall of 1988. I had to spend two weeks there to see if I would react to the building before accepting the position. I continued to be more sensitive to exposure to irritants, such as cigarette smoke, but by using an air filter I was able to reduce the level of my symptoms. By late fall, all of my symptoms had gradually diminished at work. However, in April 1989, I was moved to a basement office which is located above the garage. The second day in the office I smelled car exhaust and within minutes was experiencing facial burning. Since that exposure I have again become increasingly sensitive to exposure to irritants, so that I cannot read the newspaper without my face and eyes burning. I recently purchased a new car and I am experiencing symptoms of eye and facial burning whenever I am in it.

The point of my testimony is to get across the fact that my life was -- and continues to be -- drastically altered as a result of exposure to a chemical or pollutant in the EPA building. Activities that I once took for granted, such as reading the newspaper, were curtailed. My life became very circumscribed during the summer and fall of 1988 while I was recovering. That summer the facial burning, coughing and chest pain were so severe that I was afraid to go places for fear I would react to something -- something I often could not even smell. My doctor advised me not to go outside if the air quality index was high because the ozone and other pollutants would affect me. That summer we had continuous weeks of poor air quality, so I had to stay inside my apartment during those days when the AQI was over 100.

I became extremely depressed about my condition. It seemed so hopeless and no one had any answers. While my supervisor was very supportive and sympathetic, there was little she could do except move me from office to office. My doctor could only advise me to leave my job at EPA and see if I would recover. I began worrying about the long-term health effects. I felt my life was completely out of control and I just did not know what to do. I eventually went to see a psychotherapist to help me deal, on a rational basis, with what was happening to me.

I think this is probably the most traumatic thing that I have ever experienced in my 38 years. While my Worker's Compensation claim was eventually accepted, and I am grateful to have received some monetary compensation, I wonder if I will ever regain my health. Based on my experience, I believe there really is nothing that can be done to help someone after exposure to chemicals or irritants. So the only solution is to prevent the exposure. Anything that Congress can do to ensure that office workers have a safe and healthy workplace will be gratefully received.

## HISTORY #5

I am 53 years old. I have been employed by the Federal government for twelve and one-half years and for U.S. EPA for eleven of these years. I have both regional experience (Region V, Chicago) and EPA Headquarters experience (Superfund Program since October 1985). I have a history of high work ratings and an outstanding work record.

On January 20, 1988, I entered my office at 7 a.m. and noticed a strong acrid smell from the carpet that had been installed with adhesive the previous afternoon. Within fifteen minutes, my eyes, face, ear canals, and lungs were burning. My voice became hoarse and disappeared and I had great difficulty breathing. I was disoriented and dizzy. My eyes and nose were running. I found later I had gone into anaphylactic shock. I left the building and stayed away for a number of days until I felt somewhat better. My doctor said that I had a severe allergic-type reaction to the carpet fumes.

Upon my return I was moved to two other spaces (the sub-basement and an area that was carpeted three months previously). I continued to become sicker and react more strongly everyday. I could not remember things, I could not concentrate, and I had other symptoms of neurological problems. I was in severe pain. I continued to be unable to talk after being in the building. On the advice of my doctor, I left the building for five to six weeks until I recovered. My doctor only allowed me to return to work if I was placed in an area without ongoing renovation that was determined to have fresh air intake, and ventilation according to existing ASHRAE standards.

I returned to work at the end of March and was told by both my supervisor and a contractor with EPA's Health and Safety Office that there wasn't anywhere in the building that could meet ASHRAE standards. My supervisor told me I would have to work where the rest of my section had been moved while our old work area was renovated. I experienced reactions that continued and became more severe from morning to afternoon and from Monday to Friday. The ventilation in the area was poor. All my symptoms were documented on a daily basis by EPA's Health Unit. Within ten days of my return to work (most of the day would be spent outside), my symptoms were unbearable and neurological problems returned. On April 7, 1988, new carpet was installed in a nearby area. I went into anaphylactic shock even more severe than I experienced on January 20 and was helped out of the building. On advice of my doctor, I have not reentered it since.

It took months for my lung pain and neurological disorientation to become less severe. I was without normal use of my voice for seven months (extensive speech therapy helped it recover), although I lose it upon exposure to indoor pollution. I became reactive to other compounds and chemicals, paints,

solvents of all kinds, gasoline fumes, fuel oil, perfumes in all products, cleaning compounds, cigarette smoke, most indoor environments, etc. I am limited on where I can go and must wear a respirator to ride in a car.

Prior to my exposure at EPA, I had problems with cigarette smoke, but was otherwise healthy. I jogged approximately 4 1/2 miles four or five times a week, lifted weights, did aerobics, and had good lung capacity. I cannot jog now, due to severe lung pains. I have been rushed to a hospital when exposed to paint fumes, due to inability to breathe.

I have been on leave without pay and had no income for seven months. Since then, I have gotten workers compensation. Other EPA employees who were directed by their doctor not to enter Waterside were allowed to work at home or elsewhere, but I was not. The alternative work space recently acquired by EPA has a whole-building ventilation system where paints and solvents recirculate and cause me to react again. After my leave without pay ends in August, EPA has no obligation toward me and I will not have a job.

One time, I tried to find a job elsewhere, but no one would hire me due to my health problems. There is a high probability that I will be unable to find an office in which I could work without damaging my health.

I have 21 years of education. I have invested thousands of dollars in my education, as has EPA. My career, my private life, and that of my family have been irreversibly affected. My health and my income are tenuous. I am at risk whenever I leave my house. Due to indoor air pollution at EPA, my life is no longer within my control or what it should be at this stage of my life.

**HISTORY #6**

During Spring 1988 when my office on the Ninth Floor of the East Tower was recarpeted, I developed irritating symptoms which lasted four to six months. These included dry throat and itchy eyes. I was unable to sit at my desk for long. I had headaches and trouble concentrating. I went to the Library for fresh air, but found the air there even worse.

I still find the building irritating, but no longer have these symptoms.

**HISTORY #7**

I am a very sensitive person to begin with. In May 1988 I went to a person's office in the basement of the East Tower to give research assistance. The office had been carpeted in January. Within minutes, hives started to break out on my fingers and arm.

I asked him, "Do you have a cat?"

"No."

"Have you been in someone's house who has?"

"No. ---- Oh! You must be one of them. Some people react to this office."

The hives went away in a couple of hours.

\* \* \*

Around this time I attended a meeting in the Fifth Floor East Tower Conference Room. The new furniture there gave off a "new" smell. I went in the room perfectly normal. Within 15 minutes I lost my voice and started coughing. I couldn't stop coughing and had to leave.

**HISTORY #8**

When my work area was recarpeted in early 1988 I experienced severe headache, body weakness and pain, and eye and throat irritation. My symptoms are specific to Waterside Mall.

This past winter I have been working in the alternative work space. I am able to go to hazardous waste facilities with no effect. I have no general chemical hypersensitivity.

**HISTORY #9**

At 4:30 P.M. on Friday, April 22, 1988, EPA removed the old rugs from my office 932B in the East Tower and replaced them with new ones. The entire half of the 9th floor had its rugs replaced with new ones. I observed the process while I was packing my office so that the workmen could move my office and personal belongings.

I returned to work at 6 A.M. on the following Monday. I had sustained a very severe headache by 3:30 and went home. The headache ameliorated over the evening. I went to work at 6 A.M. on Tuesday and by noon the headache had returned, my throat had swelled, I had difficulty breathing and was dizzy and light-headed. I had shortness of breath, my voice became hoarse and my eyes were red and irritated. I lost my stamina to work for periods of greater than one to two hours at a time. On April 26th I was reassigned to the library to work. Similar problems developed, so I attempted to work in the basement of the East Tower, far removed from the areas being carpeted. I became progressively worse in that area. It turned out that the basement area had been recarpeted a few months earlier.

I was exposed once again on May 15th when my supervisor against my doctor's explicit instructions required that I meet him in an office that had recently been carpeted. After 20 minutes of exposure, my lungs felt as if they were on fire, my shortness of breath became acute, my hoarseness worsened markedly so that my voice became unrecognizable and I was not able to carry on conversations for more than 30 minutes. I became light-headed and confused.

On or about June 20th at the insistence of my supervisor, I attempted to work in the public library, Southwest Branch, next to EPA. After about 10 minutes, I had shortness of breath, tightness in my chest, hoarseness, confusion, headache. I looked around the library and found at least six new rolls of carpet. I asked my supervisor if he was aware of the carpet in the library and he said that, yes, he had observed them earlier before he suggested that I attempt to work there.

After that I remained at home working on assignments and turning them in to branch chiefs in my office. My stamina has not returned. My hoarseness, though better, returns from time to time. If I become exposed to any new or fairly new carpet my symptoms return immediately. I cannot go into buildings without wondering if I will become ill. The Fairchild building had carpets laid in the hallways and corridors and that made me ill. The EPA offices in Crystal Mall #2 had carpets installed on a different floor from where I was at a two hour meeting and I became ill. I entered a newly-constructed building to pick up a letter and remained for less than ten minutes and became ill.

## HISTORY #10

I have worked without incident at Waterside Mall for several years. About 3 months ago, I was suddenly afflicted with irritation of the optical and respiratory mucosa. My symptoms appear only in the building in which I work, and are apparently due to some environmental agent in the building air. Over a period of two months, the symptoms progressively worsened until episodes of acute shortness of breath and prolonged eye irritation occurred. Visits to a series of physicians and numerous expensive medical tests including lung, heart, and blood analyses, disclosed only that I was in perfect health, except for a lung function which improved upon exposure to bronchodilator, which is consistent with a historical asthmatic condition which had not troubled me for many years.

I am senior level non-managerial staff, a respected expert in my field, consulted regularly by many inside of government and out. Suddenly, I can no longer enter my office without debilitating symptoms. My management, upon recommendation of its occupational health physician, brought in to treat workers with indoor air complaints, has generously provided alternative workspace in a nearby building. The air in this alternative building, however, which also has a forced-air ventilation system in addition to operable windows, also caused irritation of my mucous membranes. Only after the ventilation ducts were sealed off and outdoor air brought in by a window fan, did the symptoms alleviate.

At this stage, it has been 3 months since the onset of symptoms, and I have consulted 3 physicians and undergone tests in two hospitals. Both the government and my private physician advised me to either clean up the building or stay out of it, that allergy injections will be of no avail. I am faced with the continuing prospect of isolation from my work group. In addition, my supervisor has complained that my work productivity has been declining, and although he sympathizes with my plight, he suggested that working longer hours and more attention to work will be necessary to avoid adverse consequences such as a disability retirement. Yet I am fatigued from my health problems, and have to work harder just to maintain access to ordinary information and services, as well as cope with setting up a new office with less access to the means of production than before.

I face recurring symptoms whenever I enter the building, isolation, job insecurity, medical bills, financial insecurity (with children in college and a mortgage to pay), and if I should change jobs I have no guarantee that I will not encounter another problem building. Moreover, changing jobs may mean I can no longer pursue my specialized area of expertise. A disability retirement means a very large reduction in income. Like many sick building victims, I face continuing stress, fatigue,

frustration, anger, isolation, fear, uncertainty, and the prospect of being written off by my management, as well as the possibility of financial disaster. Although this problem has been caused by the building environment, the probability of success of a lawsuit, given the current lack of understanding of these phenomena, appears low.

In sum, there is clearly a need for an understanding by management of what happens to victims of Sick Building Syndrome, some system of public health training and accountability for those who run buildings, and a need for development of an organized support system to aid individuals handicapped by sick building syndrome.



## HISTORY #11

Prior to March 1988 I had no problems working in any building. In early 1988 new carpet was laid in the halls on the floors where my branch and division are located. During late Winter, building renovations, including new carpeting, occurred in the halls outside my branch's and division's space. Half my branch moved into newly-renovated space in early April.

Sometime in late March 1988 I began to feel occasional "mono-like" symptoms at work, which cleared up after work. These symptoms worsened over time and included headache, fatigue, head swimming, and piquedness. By mid-April, I was feeling sick by midweek and would not feel better until late Sunday. By May, the time during the week before the symptoms would appear became shorter and the time away from Headquarters it took to feel better became longer. By May, I continued to have difficulty concentrating, even after I would no longer otherwise feel sick.

I tried working in the West Tower, limiting my travel to other parts of the building; but I experienced reactions within a day and a half. Upon medical advice and with my management's support, I started working at home in mid-May.

In August, I was stationed at the office of a subcontractor. I experienced mild to moderate effects from the building within a half hour to 45 minutes, but since my symptoms didn't usually get worse, I was hopeful that this arrangement would work out. Major renovations began on the building in October, although not on my floor. I started getting sicker and sicker.

With the support of my program management and the office of EPA's Assistant Administrator for Administration and Resources Management, I started working in Crystal Mall #2. Typically, I get mild to moderate reactions to the building after a half hour to 45 minutes. These get much worse during building activities, such as painting, work above drop ceilings, and when people use jet-ink printers, markers, nail polish remover, and yellow highlighter.

I want to continue working for EPA, even though I never know what surprise is next in store. EPA's facilities coordinator at this building is sympathetic and cooperative. He has tried to alert me to various activities going on in the building, but his jurisdiction is limited.

In my branch here at Crystal, when new furniture, which had been on order for over a year, arrived, I became very ill and continued to react for a month whenever I went into my branch chief's office. When I have gone to the shopping and dining area underneath my office building, I have on occasion gotten ill from emissions into the open areas from the continual store renovations and from other activities, such as gluing at a shoe repair shop.

I have had to change how I go about things at work and away from work since last May. Short exposures from seconds to minutes can make me very ill for hours, days, and even a week at a time.

**HISTORY #12**

One day in 1981, I got off the elevator on the Third Floor of the East Tower at Waterside Mall. New carpet had just been installed. My eyes started burning and tearing and got scratchy and red; my throat and lungs started burning; and I became short of breath. I was sick for three weeks.

Most of my division was away at a retreat, but one other person did get sick with chemical bronchitis. This person was sick for two and one-half weeks. She continues to this day to react with burning eyes in fabric stores and she can't stand the smell in them. When she goes into carpet stores, she finds the smell so noxious that she gets physically ill.

My division ordered tests of the carpet at an EPA test facility. They determined that the glue for the carpet was involved. It contained pentachlorophenol and other volatile organic chemicals. Pentachlorophenol is a sensitizing agent and a suspected oncogen (causes tumors) and fetotoxin (harmes fetuses).

Several women in our division were pregnant at the time. The other woman who got sick finally had to revert to Congressional pressure to get EPA to stop using this glue.

Except for some allergies, some sinus trouble, and broken bones, I had not been sick before. Since this exposure, I have had a lot of trouble getting rid of colds and have had pneumonia three times since 1981. Since 1981, I react to spraying, new carpet, and heavy perfume - and I love perfume - with wheezing, burning eyes, dizziness and nausea. I have lost perhaps two to three months work since 1981 because of this. Before this, I used very little sick leave.

**HISTORY #13**

In late October 1986, new carpeting was installed in all of the offices in my division in the West Tower. During the first two weeks after installation, once I had been in the office for an hour, I would experience eye irritation, sore throat, aching lungs, headaches, and nausea. These symptoms ceased within an hour of leaving the immediate office area. As time went by, my sensitivity increased, so that I could not spend more than 15 minutes in a newly carpeted area without reacting, and the degree of reaction increased. Shampooing the carpets helped somewhat, but not enough for me to be able to stay in the office. My supervisors were extremely helpful and arranged alternative work space for me. Because of my continued sensitivity to the carpets, I was not able to return to my office for three months.

Since this incident, my sensitivity to new carpeting has remained high, and I am unable to spend more than a few minutes in a newly carpeted area without serious discomfort.

Here is how EPA's administrative management handled this situation:

On October 29, 1986, I spoke on the telephone with a representative of EPA's Office of Occupational Safety and Health (OSH) about the problem I was having with the carpet. He said he was looking into keeping the ventilation dampers open at night and would look into cleaning the carpets to eliminate odors. He referred me to his office's industrial hygienist.

I notified a union representative of the problem sometime in November 1986. She accompanied me to a meeting with the industrial hygienist of OSH on November 17th. The industrial hygienist gave us copies of the indoor air quality readings done for Waterside Mall by a lab at RTP, North Carolina, as well as material safety data sheets on the carpets. She told us that the Agency had switched from glue to padding in carpet installations in the early 1980's, but had recently returned to using glue. The union representative told the industrial hygienist that she would like to see the Agency do a health survey to determine if indoor air quality was causing employee health problems.

On November 19, 1986, my Division Director called EPA's Director of OSH to discuss the problem. The Director of Occupational Health and Safety said he thought the problems were caused by phenolic solvents and formaldehyde, and that these substances should finish offgassing after about 2 weeks; the problems caused by this offgassing were worse if gluing was not "done right." He said that if there was adequate ventilation in areas where new carpets were installed, there shouldn't be a problem with them.

## History #18

### Prior to Illness

I am 26 years old. I have a BA in Reclamation and Spanish from Frostburg State University and a Master of Environmental Studies from Yale University. I began working at EPA in July 1987. I enjoyed my work very much; it was challenging and interesting. I had a great deal of responsibility and found that rewarding. I was also fortunate enough to work with people whose company I enjoyed. Thinking about my future was exciting. I was also very active, had a great social life and excellent health.

### When I Became Ill

In February and March 1988, I started to experience health problems, such as unusual fatigue, amenorrhea, abnormal acne, nausea, headache, burning eyes, runny nose, sore throat, diarrhea, dizziness, clumsiness, memory lapses, irritability and difficulty concentrating. These symptoms coincided with progressive renovations on my floor, but I didn't associate the two.

My symptoms continued and I often felt mentally dull and overwhelmed by the type of work I had completed successfully before. I also found that I always felt better in the evenings, in the early morning and on weekends - when I was not at work.

We moved to a newly renovated office on Monday, March 28. The chemical odor was very strong and I began to feel awful. All my symptoms grew worse and I became more disoriented and confused. I began to realize that my problems were related to the materials used in the renovations, as with people who are often affected by fresh paint fumes. On Friday I began to feel worse than ever and literally could not perform my duties. That afternoon I ended up sitting at my desk, eyes and nose running, arms and legs numb, throat closing up, gasping for breath and barely able to speak or move. Someone happened by, and I gestured for help. I was helped outside and we encountered my boss, whose only question was, "Are you reacting to that stuff?" After reaching the outdoors and sitting for a few minutes, I began to feel better. Over the weekend my muscles ached, I felt weak, and I slept a lot.

On Monday, my boss advised me to avoid the new office until the fumes had dissipated. I worked in the library and other parts of the building, but still felt poorly. On Thursday, April 7, I arrived at work feeling fine. Ninety minutes later I was helped outside again. The nurse was summoned and told me not to go back inside. She sent me to the hospital. Of course, by the time I saw a doctor, I was feeling much better. He found nothing wrong except that I was slightly "out of it."

The doctor referred me to an Occupational Health Specialist who advised me not to return to Waterside Mall until the "environment is more clearly defined." That was just the beginning of my visits to doctors and my medical bills. I've seen other Occupational Health specialists, an allergist, a gynecologist, a neurologist, my general practitioner, and a clinical ecologist. I have also researched this medical problem extensively and discussed it with many people. The diagnosis? I have multiple chemical sensitivities resulting from an exposure to something at work. The treatment? Avoid the source of the problem and other irritants. There is not much else I can do, except eliminate as many sources of irritation as possible.

### Since My Illness Began

I have been working at home. In fact, I have spent the majority of time at home. At first I tried working in other buildings, where we have additional offices, contractors, training classes, etc. I always ended up reacting to something and leaving very ill. My exposure to the renovation materials at EPA caused me to become sensitive, or allergic, to many other substances, some of which I can identify, others I cannot. For example, I cannot tolerate natural gas and I have to avoid all buildings where gas is used so that I don't become ill. I have just purchased a home and had to renovate so that it is completely electric. I feel ill at gas stations, stores, department stores, office buildings, others' homes, restaurants, malls, etc. Some places make me react worse than others, but there are only a few safe havens where I can spend an entire day without experiencing some adverse symptoms. Some reactions are caused by things like cleaning products, building materials, carpets, paints, and finishes and preservatives on new products. Most buildings are so energy-efficient that all sorts of irritants have built up and are not dispersed with enough fresh air. The most frustrating reactions are those that I have in such buildings, where I don't know exactly what is causing the problem, and those that I have outside, caused by construction, exhaust, air pollution. Even my skin is extremely sensitive to sunlight now! Before this problem at EPA, I didn't even have hayfever and my only allergy was to poison ivy.

### The Present

Now I spend most of my time at home. I try to use nontoxic products and avoid irritants and problem places. I become ill on the Metro and on buses, and I have no car, so I am restricted by transportation as well as by problem places. My social life is not as satisfying and I do not feel as healthy as I used to. I also do not feel as mentally sharp and find it difficult to concentrate on mental tasks. My memory is not as good.

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Sometimes during November, I also met with the person in charge of carpet installation in EPA's Facilities office. The Facilities person said that the carpets were not glued down, except that small amounts of glue were being used in the protective strips underlying the carpets in each doorway. He called the carpet manufacturer to obtain information on the constituents in the glue. We learned that ethylene glycol and morpholine were in the glue, and that the carpets were rolled and packaged when they were still warm; the manufacturer said that when they were reopened, pent-up gases might be released which could cause eye irritation. The Facilities person had the carpet in my office shampooed in an attempt to alleviate the problem I was having.

My branch's office is on the third floor of the Mall at Waterside. The office was remodelled and new carpets were installed during Winter 1987-1988. We moved back to our office in January 1988.

There was a noticeable odor in the office. We tried to vent the office by leaving the corridor doors open and running fans for a couple of weeks. The odor lasted for over six months. Around the corner fifty yards from our office, a sensitive person who is not in our branch had to leave her office because of the emissions coming from our remodelled space.

Throughout the first half of 1988, five out of the seven people in my branch complained of headaches and throat and eye irritations.

We heard that EPA's Facilities Management Division had said that the carpet had not been glued down because the use of glue had been discontinued for some time, but I personally watched the carpet being glued. The glue had a golden to orange-brown color.

My personal illness has continued to this day. I had no previous health problems, except for occasional flu brought home from school by my kids. Now I catch anything that comes by. I have had an ear infection, strep throat five times, and five or six rounds of flu. In between illnesses I run a low-grade fever for which my doctor cannot find a cause. I now sweat easily, which is awkward in a professional setting, such as in meetings. I walk down the hall for a drink of water and I break out in a sweat. When others in my office have heaters on, I get in front of a fan. I feel like I am now known as "Mr. Sick." People are always asking me if I feel better.

I have no direct information saying that my illnesses are related to my office, but the coincidence with the timing of the renovation is strong.

I have not reported my health problems to EPA's Health Unit because I am uneasy about my anonymity being preserved.

My career has suffered. I am working at home. I was due for a promotion in August 1988, but my boss said that my situation made me lose it. I simply cannot work as effectively at home as I could at the office. Since I can hardly go anywhere, it's hard to find another job. Now, when I think about my career future, it's not exciting. It's scary.

#### HISTORY #16

#### HEALTH STATUS

I have suffered major illness which may be permanently debilitating, as a direct result of carpet installation and construction at EPA. Since September 1988, I have taken over \$1,500.00 of prescription drugs including systemic and inhaled steroids and a nasal spray containing a steroid. I have experienced a variety of side effects as a result of taking these drugs including partial suppression of my adrenal system (now normal), severe respiratory system inflammation, other severe respiratory insults, and possible stress to my heart. My condition has progressed so that I now experience symptoms of acute chemical hypersensitivity. My personal physician's diagnosis is that I am in a hypersensitive allergic state.

Specific examples of my symptoms of chemical hypersensitivity include respiratory tract inflammation from exposure to volatile emissions from zenith computers and volatile emissions from other plastic products such as the hard, smooth black plastic used in many Radio Shack products. I have also stopped reading newspapers and some other types of printed materials because of a reaction to the inks. I have not experienced symptoms of hypersensitivity prior to my exposures from my work environment at the EPA Waterside Mall Complex.

My physician has recommended a multiple modality treatment for my condition which includes a three to five year series of allergic desensitization injections. The shots are very expensive; I have yet to start one especially costly series because of lack of funds. Additionally, I now take time from my workday twice a week in order to take these shots. Spending time during the workday to travel to the allergist's office to receive these shots is impacting my ability to get my job done in a timely manner.

#### FINANCIAL IMPACTS

I have incurred medical bills of over \$2,750.00 since September 1988 as a direct result of exposures in the EPA Headquarters Waterside Mall Complex. The outlay of thousands of dollars in medical expenses has caused great harm to my financial well-being. I have been on a very tight budget and have not been able to sustain the outlay of thousands of dollars in medical expenses.

#### ARMY DETAIL

After a multistage negotiation, The Office of Personnel arranged a detail for me to the Army Materiel Command where three-fourths of my salary would be paid by EPA and the Army would pay for the remaining quarter FTE. This detail was an usual short-term solution to the situation at EPA and

would allow me a year to seek permanent employment elsewhere. However, the Department of Defense has made a blanket purchase of Zenith computers to which I have an allergic reaction. Upon entering the Army office to which I was assigned, I experienced an immediate blockage of my ears, followed by a burning throat and swelling of my neck. Later in the day my lungs began to burn and tighten. The Army management responded to my problem by locating another office with a lesser number of computers. I returned about two weeks later for a day to check out that space. The severity of my response was of the same order of magnitude as that to the first Army office. The Army folks were very disappointed that the detail fell through, as I was, especially after having spent many hours over several months negotiating this detail. The Army requested that I be replaced by another EPA person because they had structured a job specifically for a person with a one-year tour of duty.

#### CAREER IMPACTS

I have never been allergic to plastics or inks prior to my EPA building exposures. I have become chemically hypersensitive as a result of my EPA building exposures, and my employment opportunities have become greatly reduced because of my newly acquired, building caused, chemical hypersensitivity, specifically to emissions from materials used in Zenith computers. The possibility of employment by the Department of Defense has been greatly reduced due to their blanket purchase of Zenith computers.

#### EXPENDITURE/INVESTMENT OF UNITED STATES TAX DOLLARS

The direct investment of time and money the United States Government has made in support of my education and employment is substantial. The United States Navy supported me and research for my dissertation for three and one-half years while I completed the requirements for my PhD. Since receiving my PhD in December of 1982 I have worked in the environmental field for the Navy (one year) and for EPA (five years). The United States Government investment in my dissertation research and employment, using an overhead factor of 1.0, is over \$580,000.00, not an amount to be taken lightly or to be thrown away.

The monetary costs of the potential loss of professional careers at EPA Headquarters resulting from exposures to \$300,000.00 of faulty carpeting are clearly an order of magnitude higher than the cost of the carpet. It is not cost effective to throw away or get rid of affected employees and their expertise instead of the carpeting. Additionally, the much discussed possibility for disability status for affected employees should be for those individuals incapacitated by accident or standard illness, not from assault by carpet exposure. Moreover, disability was never meant to be used as a surrogate for proper building operation and maintenance or product safety liability, standards and procedures. Although Waterside Mall exhibits characteristics of "sick building syndrome," the acute and severe illnesses experienced by EPA Headquarters employees since the installation of the affected carpet implicate the carpet as a causal agent and initiator of many severe health effects.

The next day, February 14, 1989, I returned to my HMO and was finally referred to an Internist. I was diagnosed as having an upper respiratory infection. Congestion in my left inner ear most likely caused the vertigo episode the previous evening. However, the doctor was puzzled by my red, painful eyes. Several x-rays of my head were taken to determine if there might be some congestion around my eyes that would have caused the redness and pain. No congestion was found in the areas around my eyes. I was prescribed a decongestant and was advised to continue with the antibiotics. The doctor also recommended that I stay home from work for the remainder of the week. I did not go in to work the following day.

Since I was feeling better, I decided to return to work that Thursday. Within three hours of being back in the building, my eyes were not only throbbing with pain but also became swollen. The severe headaches also returned. I spent the following day sick in bed.

On March 1, 1989, I was examined by EPA's contract doctor who stated, in a letter to my Division Director, that he found evidence of severe conjunctivitis and bronchitis and that my symptoms were indicative of an occupationally-related medical disorder. He also stated in the letter that he was concerned about the severity of my illness and "strongly" recommended that I be provided with alternate work space as soon as possible.

Although most of the painful symptoms have diminished, I occasionally feel the pain around my eyes and have headaches if I stay in the building too long. I am also experiencing other symptoms, such as the inability to concentrate, memory loss, confusion and occasional difficulty in speaking.

Due to my "illness," I have had to restrict my social life and extracurricular activities. This included my resignation as a board member of my State Society.

The request for alternate work space is still being processed. (It has been about two months now.) At any rate, I am actively seeking other employment either at the Crystal City Office of EPA or outside of the Agency.

**HISTORY #17**

In mid-December 1988, I accepted a position with the Environmental Protection Agency and looked forward to a new and challenging job. To the best of my recollection, I do not remember ever being warned about the "sick building syndrome," being advised about employees who have become ill as a result of working in the building, or being told that new carpet installed in my office the previous Spring had adversely affected some people.

The office in which I am working is located on the 2nd Floor in Southeast Mall at EPA Headquarters.

When I first started working at Waterside in mid-January 1989, renovation activities were occurring in the EPA guard area by the "Safeway" entrance. Within a week after I came on board, I became ill with flu-like symptoms which included fever, body ache, and headaches, and had to stay home for two days. Given that this occurred in the middle of winter and the "flu season," I did not think it was anything unusual. However, most of the symptoms remained and continued to progress. Both of my eyes were blood red and painful and my headaches were excruciating. As far as I can remember, I have never before experienced such debilitating pain.

On Friday, February 3, 1989, I went to see the Advice Nurse at the HMO to which I belong. I was given a prescription for the treatment of conjunctivitis and was told to return if the medication did not effect any improvement. I was back to see the Advice Nurse within four days on February 7, 1989. I was also running a low-grade fever. I was given another medication for my eyes as well as an antibiotic.

Although I felt very ill, I continued to come in to work, as I had just started this job, was in the middle of training, and felt guilty about staying home! The symptoms continued, and I also began to experience new symptoms. I became so congested that I could hardly hear out of my left ear. I also felt nauseated at times and experienced dizziness. There was a "tingling" feeling on my scalp and some numbness in my arms. Not only were my eyes red and painful, but I also began to see black spots and "waves," particularly out of my left eye. There was also a gelatinous growth on the same eye.

About an hour after arriving home from work on February 13, 1989, I almost fainted. Fortunately, this did not occur while I was driving home from work on I-66. I recall talking to my sister about how painful my eyes were and that the headaches just did not seem to diminish, when the room I was in suddenly appeared to be spinning and I felt my body going limp.

**APPENDIX II**

**EPA'S INDOOR AIR POLICY**

**Petition to Administrator William Reilly**

**Indoor Air Quality at Waterside Mall**

Attached is a letter to Bill Reilly expressing concerns regarding the quality of air at Waterside Mall. The goal of the petition is to obtain as many of the signatures of concerned employees as possible in order to demonstrate the breadth of this problem to Mr. Reilly.

Multitple copies of the petition are being circulated within most offices of EPA. Please review the letter to Mr. Reilly and if you support its message, please sign the petition. Whether or not you choose to sign, please pass the petition on to fellow employees.

The goal is to obtain all signatures by Friday, October 13, 1989. Please return all petitions to the Mr. Robert Knox of the Human Resources Council (mail code = OS-130, room number = 2111). Signed petitions will be submitted to Bill Reilly as soon as possible.

Thank you for your interest and support for this very important issue!





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

The Honorable William K. Reilly  
Administrator  
Environmental Protection Agency  
401 M Street, S.W.  
Washington, DC 20460

Dear Mr. Reilly:

The purpose of this petition is to express our concern regarding the indoor air quality at Waterside Mall, and to encourage you to become personally involved with the expeditious resolution of this issue. Whether the effects of the air quality in the building are real or perceived, the controversy surrounding this issue has demoralized Agency employees and distracted them from their important mission of protecting the nation's public health and environment. The current conditions at Waterside Mall present a confusing and ironic message to those outside the Agency, and undercut our credibility with regard to the mission of the Agency.

Over the course of the past year, a number of EPA employees have had severe reactions to working in the Waterside Mall complex, and as a result, these employees have been reassigned to office space outside of the building. While difficult to prove, it is strongly suspected that these reactions have been caused by conditions related to poor indoor air quality. There are many other employees who have experienced other less severe reactions, such as; headaches, dizziness, respiratory irritations, including shortness of breath. In addition to the physical problems experienced by these employees, there is added anxiety that their conditions may worsen to the point that they too, will not be able to work in the building, and perhaps be limited in their career paths.

In response to this issue, a number of studies have been performed to identify and resolve the air quality problem. While study of the problem is important, it appears that some of these studies may not have been comprehensive in nature, and may in fact have raised more questions than they answered. Additionally, the results of some of these studies and other pertinent information have not been made available to employees at Waterside Mall, further undercutting the confidence level of many. For example, the employees were not made aware of the concerns and recommendations raised in the June 25, 1989, letter from Dr. Mark Bradley. There is also concern that the Agency will continue to study the problem, and take no interim measures to ameliorate the situation.

Indoor air quality at Waterside Mall remains a very serious issue which EPA must address. There is little doubt that a limited number of employees have already been seriously affected, while many others are experiencing less severe problems but are worried about future effects. In either case, the result is a less productive and effective workforce and a dampening of our ability to attract and retain qualified personnel. As evidenced by numerous articles in the press, and concern expressed by Congress, the current conditions at Waterside Mall raise questions regarding our ability to fulfill EPA's mandate to protect human health and the environment.

We hope that this petition will demonstrate to you how seriously the employees of Waterside Mall view this issue. We strongly encourage you to make this issue one of your top priorities and take immediate actions to address these problems. We regret having to bring this to your personal attention and would greatly appreciate hearing from you directly in the very near future.

Attachment (Petition signed by EPA Employees)

656 EPA EMPLOYEES SIGNED THIS PETITION

RJC



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

NOV 21 1999

Honorable William K. Reilly  
Administrator  
US Environmental Protection Agency

Dear Bill:

We are forwarding a letter initiated in OSWER and signed by 656 staff and 84 managers from several Agency organizations which seeks your immediate assistance in remedying a wide variety of building-environment problems with Waterside Mall. We have recently toured most of the OSWER office space on the second and third floors of the Mall, met with employees in alternate space in the adjacent apartment building, and conducted a meeting with all our managers to explore the full dimensions of the problems and consider actions to rectify them.

These meetings and our personal examination of working conditions convince us that several employees have experienced significant health problems for which the building environment seems to be the most likely explanation. Many other staff have experienced less severe symptoms that may be associated with the building and which give them concern about possible chronic or subchronic effects. Almost all employees frequently suffer discomfort due to fluctuations in temperature and uneven air circulation, noise, lack of natural light, and crowding.

In addition to concerns about our employees' physical and mental well-being, there can be no doubt that the working environment in many areas of Waterside Mall prevents our staff from performing to their full potential and are a liability to us in today's very competitive climate of employee recruitment and retention. As senior managers, we are acutely aware of the size and difficulty of the job we expect the OSWER staff to do, the climate of high expectations and controversy in which they operate, and the potentially serious implications for our programs of any loss in productivity. Our staff members are proud of their accomplishments,

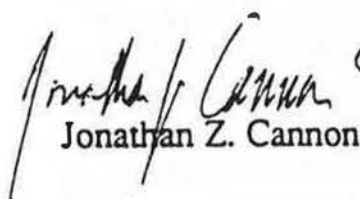
as evidenced by the citations posted in many of their workspaces we visited, and want to do their best for the Agency. We also sensed that many of those affected by the working conditions have been reluctant to press their concerns on senior managers whom they know are grappling with many difficult and controversial issues of national importance. They don't wish to be another "problem" on our list. But as the potential occupancy date for the new building has been pushed into the future, the frustration with OARM and Town Center Management's efforts to "stay even" with deteriorating conditions has grown, and concern for the well being of colleagues seeking medical attention or alternate work space has built. Personnel at all levels are respectfully urging us to act.

While many areas of Waterside Mall are beset with problems, we think the conditions on the second floor and some portions of the third floor of the Mall warrant extraordinary measures. We believe that employees in these areas should be relocated to space of quality comparable to or better than the tower space, as quickly as possible. The space which is vacated could be converted to conference space, file storage, and other uses which would not require permanent occupancy. OSWER managers and staff do not want their problems alleviated at the expense of other agency staff.

We recognize that there will be management challenges for OSWER from having some units in the Waterside complex and others in another facility. However, when balanced against the health concerns and management problems posed by existing conditions, we believe that relocation is the proper course. We can also appreciate that there will be substantial costs and effort involved in procuring space elsewhere and are prepared to go to great lengths to assist you and Office of Administration and Resources Management and the General Services Administration in resolving this difficult problem expeditiously.

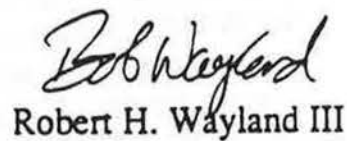
We have had initial discussions of our findings with Charlie Grizzle and he has been supportive of our request, and would like to join us in meeting with you in the near future to discuss next steps.

Sincerely,

  
Jonathan Z. Cannon

  
Don R. Clay

  
Christian Holmes

  
Robert H. Wayland III

Enclosure

cc: OSWER Managers

MARK E. BRADLEY, M.D., M.P.H.  
OCCUPATIONAL MEDICINE  
9316 FALLS BRIDGE LANE  
POTOMAC, MARYLAND 20854  
U.S.A.  
(301) 299-8826

October 20, 1989

Dr. Rufus Morison  
NFFE Local 2050  
EPA UN-200  
Washington, DC 20460

Dear Dr. Morison;

In this letter I am responding to five questions asked by the Union in reference to your requested review of the Westat-EPA Health Survey.

1a. Are EPA employees in immediate health danger?

Yes. Some EPA employees are at immediate health risk, particularly those with respiratory illnesses. There is strong indication that many employees have hypersensitivity pneumonitis, occupational asthma and irritant-intoxication syndromes.

b. If so, what are your recommendations?

My letter to Administrator William Reilly contains several recommendations that directly address this question: 1) bring in outside experts: NIOSH, Dr. Kay Kreiss and/or university experts in occupational health to make recommendations for the immediate and longer term problems, (peer selected occupational health experts engaged to assess the range of problems); 2) The use of alternate workspace is not an adequate solution to mitigate these health hazards; 3) thoroughly clean the HVAC units, replace air ducts, relocate air intakes away from pollution sources, increase ventilation rates to ensure maximum fresh air exchange, and correct the design deficiencies in all of the buildings and; 4) reduce the population density in the buildings from the present 5-6000 to the 1200 to 1500 level for which the WSM buildings are designed. (This would be expensive but it would solve many of the current crisis level health hazards in the building).

2a. Do you think there will be long term health effects?

Yes.

Page 2

- b. What long term effects do you project from the information from the survey?

I would project that members of the employee population will experience in increasing numbers, restrictive and/or obstructive lung disease, and post traumatic stress disorders. There may well be long term effects on other organ systems such as reproduction.

3. How do the prevalence (of symptoms) rates compare to expected rates for putatively "healthy" work space?

The prevalence of symptoms from the survey is astonishingly high. It is higher by an order of magnitude than I expected.

4. From the study what is your view of the EPA workplace as to morale, motivation, productivity, etc.?

The EPA HQ workplace is dirty and underventilated in places. It is overcrowded and poorly maintained. It is surprising that the workforce is able to maintain morale. Employees are amazingly dedicated under extremely adverse circumstances.

5. What are the major design flaws in the study?

The study shows very little direction and focus in terms of the design. It fails to address major areas of long term health problems related to pollution, ventilation, etc. It fails to address standard epidemiologic questions such as morbidity (number of visits per year to medical practitioners, hospitalizations, etc) and mortality rates. It does not identify specific "hot spots".

Sincerely,

  
Mark E. Bradley, MD, MPH

11-3-89  
400

From: Linda Lee Davidoff, Ph.D.

To: Rufus Morrison, Ph.D.  
fax: 382-7886

Re: EPA Employees Indoor Air Quality Survey

1. I believe that employees at EPA are at increased risk for illness. The survey suggests that many employees are already experiencing acute effects, including headaches, respiratory complaints, sinus congestion, mucuous membrane irritation, and central nervous system dysfunctions.

My recommendations would be to remove people temporarily to a building that is well ventilated while the current headquarters are remodeled so as to greatly increase air exchanges, vent fumes from specifiable sources of pollution, remove sources of pollution that cannot be vented, and adopt stringent policies to minimize all sources of indoor air pollution.

2. The health effects of chronic low level exposures to pollutants are not always reversible. The data from the TEAM study suggest that chronic exposures to low levels of VOCs contribute to the risk of reproductive problems and cancer. Such levels may also contribute to hypersensitivity disorders including hyperreactive airways and an ill defined condition, which we are studying, called multiple chemical sensitivity.

See recommendations under #1.

3. The data suggest that at least 1 out of every 3 workers feels that their health is effected to a substantial degree by the work environment at EPA. While I am not familiar with studies of worker health and morale in "healthy work spaces," I would guess that the rate of perceived health effects at EPA is very high relative to a healthy work space.

4. The survey suggests that worries about health due to indoor air contaminants and illnesses, which are perceived as work related, contribute to missed work and to leaving work early in a substantial number of employees. It is ironic that the agency that is supposed to be protecting the quality of the air is perceived as doing the precise opposite. I would guess that cynicism is high and morale low and that productivity must suffer as a consequence.

5. Design flaws: The survey did not focus enough on health effects, which were the ultimate topic of interest. There should have been in depth information on illness in the workers who perceive their health to be compromised by the work place.

THIS PAPER REPRESENTS THE VIEWS OF THE AUTHORS AND THE NATIONAL FEDERATION OF FEDERAL EMPLOYEES LOCAL 2050. THIS UNION REPRESENTS THE PROFESSIONAL EMPLOYEES AT HEADQUARTERS, U.S. ENVIRONMENTAL PROTECTION AGENCY. THIS PAPER DOES NOT REPRESENT THE OFFICIAL VIEWS OF THE AGENCY. THE DATA USED IN THIS PAPER WERE GATHERED BY THE UNION AND BY STAFF SCIENTIST OF THE AGENCY DURING AN ON-GOING INVESTIGATION OF AN OUTBREAK OF ILLNESSES AT THE WATERSIDE MALL OFFICES OF EPA, AND WERE USED BY THE UNION IN PURSUING REMEDIES FOR THE INJURED EMPLOYEES.

**CARPET/4-PHENYLCYCLOHEXENE TOXICITY:  
THE EPA HEADQUARTERS CASE**

**Bill Hirzy, Ph.D. and Rufus Morison, Ph.D  
National Federation of Federal Employees Local 2050,  
Washington, DC**

**Introduction**

This is a paper about the interfaces among science, public policy, occupational health and labor relations.

For the past 24 months the Environmental Protection Agency has been conducting an unusual experiment. The question under study was: "Let's see what happens when we introduce a source of 4-phenylcyclohexene into a marginal indoor air environment in which ca. 5000 people work for 8 to 10 hours per day. The results are in, and we, as union officials responsible for representing the test animals in this study, now publish the first portion of them.

In a nutshell, according to Dr. Mark Bradley, a well known occupational physician specializing in pulmonary and immune systems disorders, who was on subcontract to EPA to investigate employee health complaints from November 1988 through April 1989, we now have a health emergency at EPA headquarters with adverse health effects likely in the long term among EPA employees. Based on a health survey conducted in February, 1989, results of which will be released in mid-November, Dr. Bradley concludes, "There is strong indication that many employees have hypersensitivity pneumonitis, occupational asthma and irritant-intoxication syndromes".

**Background**

Now for the background and experimental details of the Agency's testing of carpet safety/toxicity on its employees. A clipping from the September 15, 1989 issue of The Washington Times, reporting the agency's decision to start removing the carpet, is included here to give the reader a flavor for the experimental zeal of EPA's Environmental Health and Safety Office in the work. You will notice in this clipping the two voices of EPA management: the first is spoken as one might expect a potential defendant to speak,



## FEDERAL REPORT

# EPA to remove troublesome carpet at Waterside

Marie Helman  
Washington Post

The Environmental Protection Agency's decision to rip out carpet at the complaint-prone Waterside Mall will hopefully reduce the number of health-related complaints, management said yesterday. Although unable to establish a causal link between the carpet and employee problems, EPA decided to remove the carpeting in areas with high frequencies of employee complaints, the EPA said in a memo.

The carpet will be removed from 10 rooms at the EPA headquarters office, 801 M St. SW by Sept. 24. David Westman, director of the Environmental Health and Safety Division, said after the decision was announced Wednesday. There is one room in particular

where the carpet will be removed," Mr. Westman said. Room 2027 is that specific room. Other rooms were still identifying based on the amount of symptoms people have reported. We recognized that some rooms continue to be complained about.

The cost of the removal "won't cost a whole lot," Mr. Westman said. "Not a large amount of money."

Management will attempt to determine what effect the removal has on employees' health problems.

"I'm very interested in seeing if the rate of complaints changes after removal," Mr. Westman said. The freshly manufactured carpet clearly caused the initial illness, but it's not clear if it still caused it after two years.

The carpet will be replaced by vinyl floor tiles. The glue used should not affect air quality and

most work will be done at night in order to air out the rooms, Mr. Westman said.

More than 100 EPA employees out of the 5,700 who work at the Waterside Mall have complained of dizziness, rashes, headaches, nausea, disorientation, memory loss and throat and eye irritations since the carpet was first laid two years ago. The severity of employees' illnesses has varied.

When complaints began to multiply, the EPA asked the Labor Department to expedite workers' compensation claims. The agency also permitted some of the affected employees to work at home. Others were assigned to other buildings.

Although air quality has been an EPA issue since the building was first leased in 1972, employees say it worsened after the carpet was laid between the autumn of 1987 and the

spring of 1988.

Air quality problems have in part been caused by the large number of workers and equipment in the building, the building's owner, Brestler and Reiner, Inc., has said. The problems are compounded because air ducts are blocked by desks and equipment.

Several studies, including those conducted by EPA management, concluded that the adhesive used to lay the 27,000 square yards of carpet released the toxic compound 4-phencyclohexene, or 4-PC.

Union officials at EPA had urged management to remove the carpet since it was first laid almost two years ago. After the recarpeting was suspended in April 1988, the EPA rejected union demands for the carpet's removal.

"Employee complaints, which formed the basis of this action by EPA management, have been in

EPA's hands since May 1988," said William Hirzy, president elect of the National Federation of Federal Employees. "We just wish they'd done it a year ago, which would have preserved the health of employees that have been injured."

Management officials yesterday asked the two unions at EPA — the NFFE and the American Federation of Government Employees, Local 3331 — to inform them of other problem areas.

"That's a move in the right direction and I'm happy the experiment on our employees has come to a halt," Mr. Hirzy said.

"Twenty people were injured by negligence," said NFFE Senior Vice President Rufus Morrison. "The actuality is people were injured after the installation of the carpet. It's pretty strong evidence."

EPA hired a technical team — independent of unions and manage-

ment — to pinpoint the problem spots in the building. A health survey was conducted in February to survey the areas of employee complaints, NFFE said.

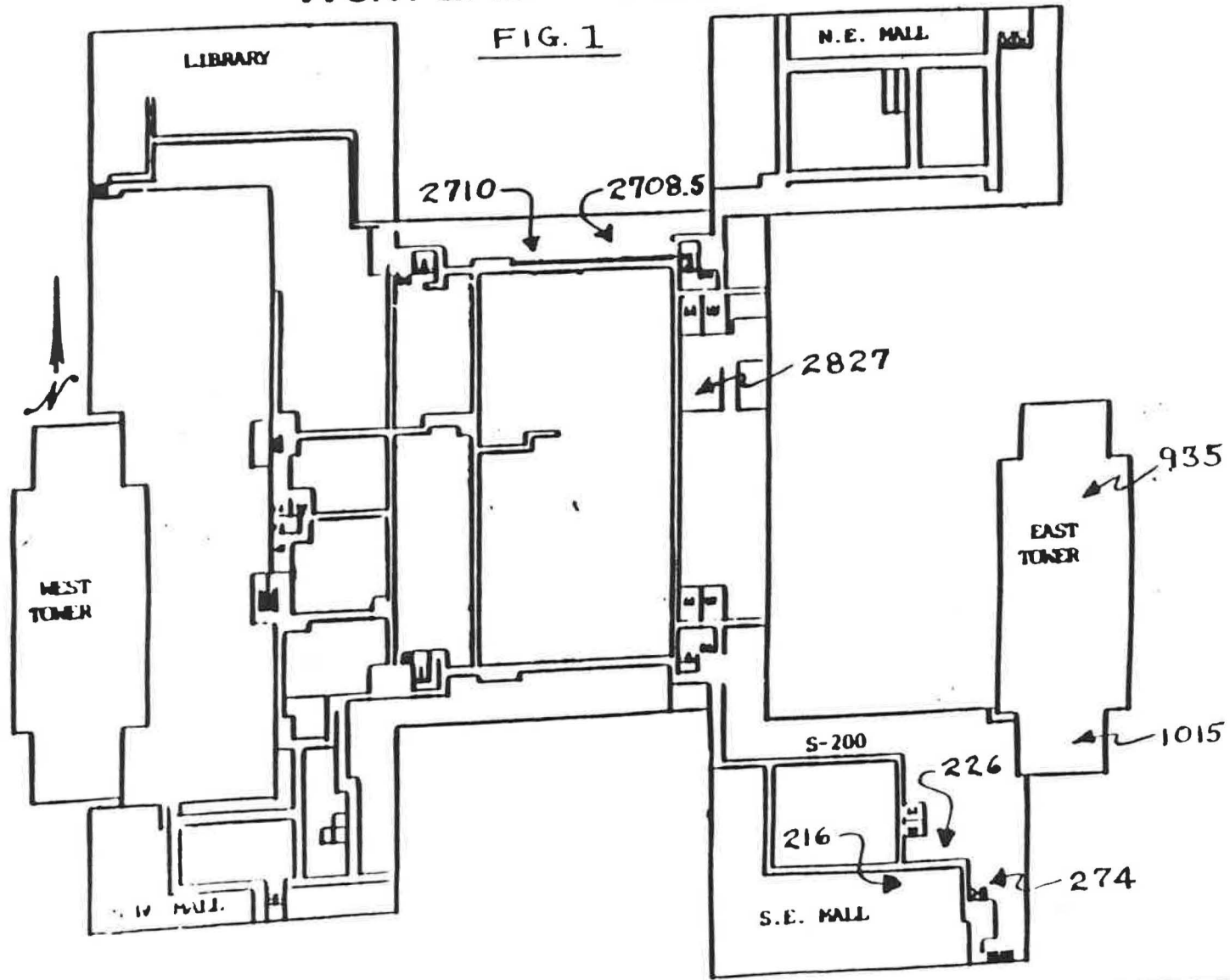
"We think [EPA acted] because there's a lot of bad news coming their [management's] way from the health survey," Mr. Hirzy said. "This exemplifies the political — as opposed to scientific bases — for EPA's actions and inactions that have so angered the public, the Congress and EPA's own staff."

Management said it tried to resolve air quality problems by spending \$1.2 million on equipment over the past four years.

EPA's Waterside Mall lease with Brestler and Reiner, Inc., ends in 1992, but the General Services Administration will most likely renew the contract and the headquarters will continue to occupy the building, Mr. Westman said.

# WSM 2ND FLOOR MALL

FIG. 1





# WSM 3RD FLOOR MALL

FIG. 2

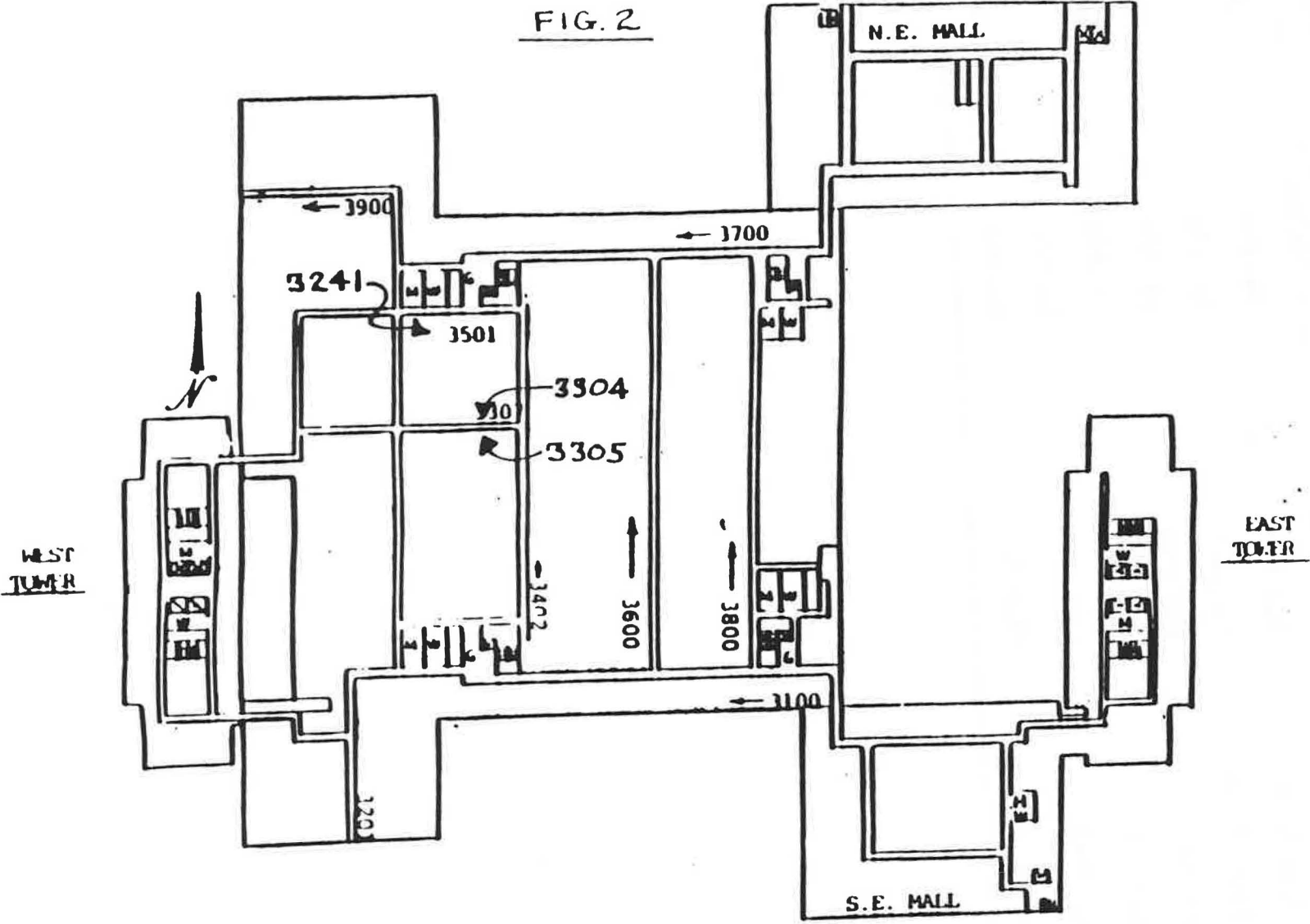


TABLE 1

DISTRIBUTION OF CARPET AND EMPLOYEES

<u>Building Segment</u>	<u>Total Area Sq. Ft.</u>	<u>Area Newly Carpeted Sq.Ft.</u>	<u>Employees</u>
East Tower	240,000	56,100	945
West Tower	220,000	41,000	737
Mall-2	150,000	29,100	490
Mall-3	150,000	11,300	615
NE Mall	132,000	16,900	536
SE Mall	48,000	33,900	274

TABLE 2

SYMPTOMS EXPERIENCED BY EMPLOYEES

Burning Eyes	Memory Difficulty
Chills	Unusual Fatigue
Chest Wheezing	Nausea
Runny Nose	Nervousness
Sneezing	Difficulty Concentrating
Cough	Depression
Fever	Dizziness
Chest Tightness	Lightheadedness
Hoarseness	Blurred or Double Vision
Sore Throat	Numbness
Joint Pain	Menstrual Problems

AND

Hypersensitivity to environmental agents resulting in one or more of the above symptoms

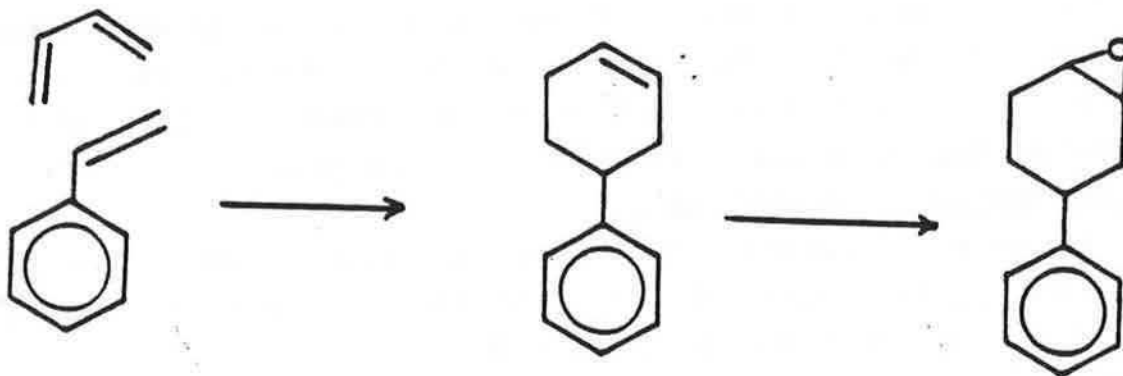
TABLE 3

EMPLOYEES WITH SYMPTOMS BY LOCATION

<u>Building Segment</u>	<u>Percent Newly Carpeted</u>	<u>Employees in New Carpet Offices</u>	<u>Symptomatic Employees</u>	<u>Symptoms Linked to Carpet</u>
East Tower	23	220	16 ( )*	10
West Tower	18	137	8 ( )	5
Mall-2	19	95	18 ( )	14
Mall-3	8	46	16 ( )	8
NE Mall	13	68	13 ( )	5
SE Mall	71	193	10 ( )	9

\* Parenthetical numbers derived from February 1989 survey  
These are 5 to 13 times larger than our earlier data & will  
be released mid-November, 1989. jmt

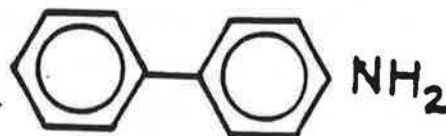
### 4-PHENYLCYCLOHEXENE



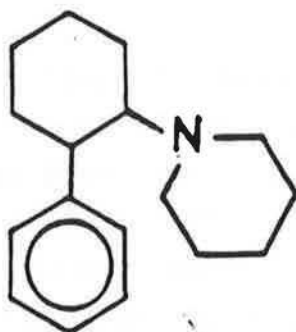
### ANILINE



### 4-AMINOBIPHENYL



### PHENCYCLIDINE





"Although unable to establish a scientific link between the carpet and employee problems, EPA decided to remove the carpeting ...."; the second is spoken as one might expect a thoughtful, observant scientist to report interim findings of a toxicology experiment, "The freshly manufactured carpet clearly caused the initial illness..... I'm very interested in seeing if the rate of complaints changes after removal" (of the carpet).

#### Exposure/Health Complaint Data

Beginning in October, 1987 EPA installed at Waterside Mall ca. 27,000 square yards of Grand Entrance III and Tuff One II, manufactured by Ebsco Mills, Dalton GA.

Diagrams of the Waterside Mall (WSM) complex are included as Figures 1 and 2 to help orient the reader and to point out the locations where air monitoring took place. Table 1 shows the total areas of the various sections of the WSM complex and the percent of those areas carpeted with the material in question.

As more and more carpet was laid, more and more complaints began to be registered by employees with their management and the EPA Health Unit. By January 1988, several employees had suffered severe reactions requiring hospital treatment, and EPA hired an industrial hygienist to compile reports of complaints and assess them. EPA also brought in its Emergency Response Team to monitor WSM air for volatile organic compounds usually measured at Super Fund sites, and measurement of formaldehyde levels were also made. Presence of 4-phenylcyclohexene was not suspected at that time, and it was not measured. (See Structure-Activity Considerations section.)

Table 2 gives a list of symptoms most commonly reported by employees. Hypersensitivity to a range of environmental factors began to appear in some of the most severely affected people. A meeting was held on April 27, 1988 at which the results of the ERT monitoring and the industrial hygienist's analysis of complaints were reported. The hygienist reported that some 60 or so employees had complained of health effects ranging in severity from irritation of eyes, nose and throat to induction of multiple chemical sensitivity (MCS), a topic we were to learn much about

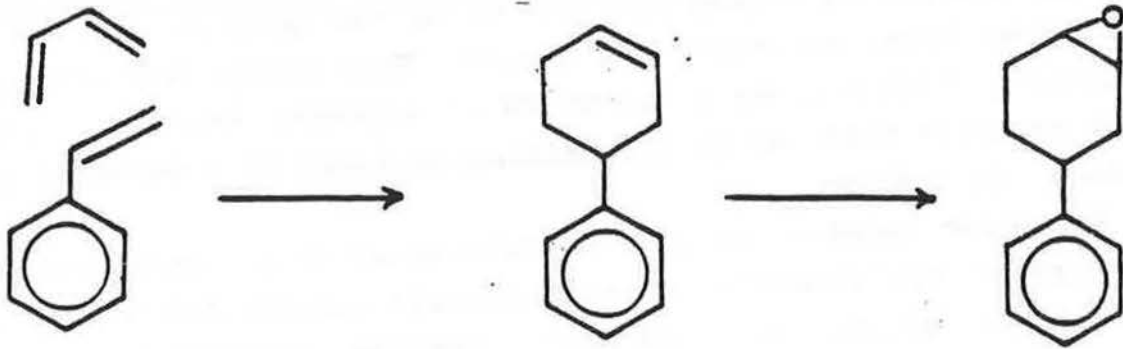
over the following months. EPA contended to complaining employees that the monitoring showed WSM air to be "as good as the air in your living room, so what's the beef?" This management attitude predictably precipitated a firestorm of protest, especially when it was reported next day in The Washington Times by a reported who attended the meeting.

The union immediately upon the conclusion of the meeting wrote to Assistant Administrator Charles Grizzle asking for a halt in carpet installation. This was done. However, management refused at that time, and continued to refuse until September 14, 1989, to remove any of the carpet in question.

In May, 1988 and again in June, August and November, air monitoring was conducted for a range of VOCs in selected carpeted and un-carpeted rooms. 4-Phenylcyclohexene was measured during these sessions. These May-November measurements complemented those taken in March, 1988 of formaldehyde levels. The formaldehyde and 4-PC results are shown in Table 4. Results for other VOCs are shown in Table 5. (Documents from which the data in Tables 4 and 5 were taken are cited in the Data Sources and Pertinent Literature Section.) The most remarkable finding was that 4-PC was the single chemical uniquely associated with carpet in WSM, and that 4-PC was the only chemical found whose levels declined significantly over the period of monitoring. In essence, 4-PC was the single chemical uniquely tied to the appearance of the illnesses that employees reported began with installation of the carpet.

The results of 4-PC measurements showed that employees who worked in carpeted areas were exposed to initial concentrations in the range of ca. 1-15 ppb. This is explained in Figure 1, which shows the levels of 4-PC in SE-226 from May through August, 1988. Employees generally did not re-enter carpeted space for about 7-10 days following carpet laying. SE-226 was carpeted in late April, 1988, one month prior to the monitoring. Extrapolating the decay curve back ca. 30 days gives our estimate of the likely initial exposure level in that room. (A projection to the November level in SE-226 is shown, derived from 4-PC measured in a nearby office [SE-274] in November, because SE-226 was not monitored in November.

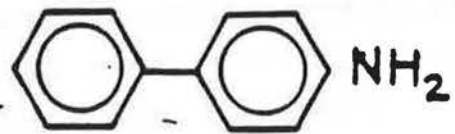
### 4-PHENYLCYCLOHEXENE



### ANILINE



### 4-AMINOBIPHENYL



### PHENCYCLIDINE

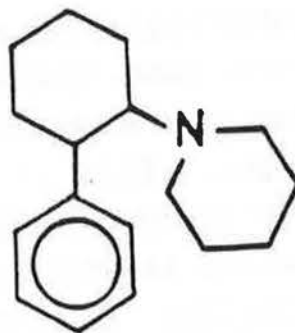


Figure 4 shows a comparison of 4-PC levels in new vs. ca. 6-month-old carpet.)

#### Structure-Activity Considerations

By April, staff of the Office of Toxic Substances (OTS) had uncovered a 1987 submission (see Data Sources and Pertinent Literature section) by Mark Van Ert linking 4-PC to complaints about building environments and new carpeting and reporting limited toxicological testing on the compound. The Agency's OTS structure-activity team, which analyzes limited data on new chemicals submitted under the premanufacture notification program of TSCA, reviewed Van Ert's submission and literature on structural analogues of 4-PC and its likely primary metabolite, 3,4-epoxycyclohexyl-1-benzene. We also reviewed literature citations from TOXLINE on cyclohexene and epoxycyclohexene, and we considered the difference in carcinogenic potency between aniline (weak) and 4-aminobiphenyl (strong). This latter point speaks to a steric similarity in the comparisons between cyclohexene/4-PC vs. aniline/4-aminobiphenyl as regards reactivity toward genetic matter and de-toxifying enzyme systems. These reviews lead us to conclude that the likely primary metabolite of 4-PC would be expected to be a fairly potent inhibitor of certain enzymes and to be reactive toward DNA and/or cellular proteins.

#### Recommended Risk Control

Based on the temporal and spacial link between carpet, 4-PC and employee illnesses, the initial 4-PC exposure levels, and generally accepted criteria for establishing putatively "safe" levels for toxic agents, we propose that indoor air standards be set for 4-PC that would protect against induction of MCS and against acute irritancy responses. The derivation of those recommended levels is shown below:

FIG. 3

4-PHENYLCYCLOHEXENE LEVELS  
IN SE-226 ~ 1988

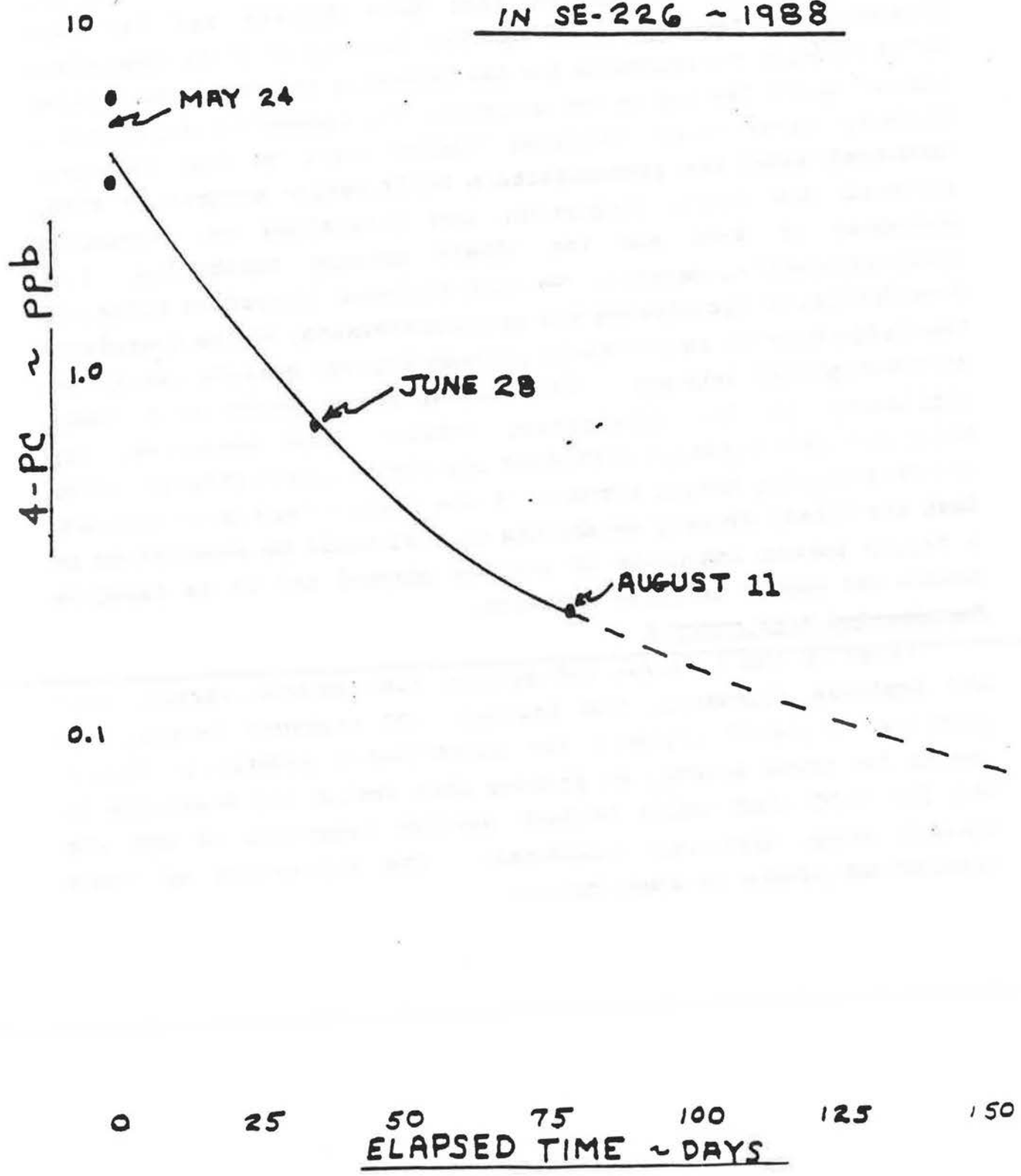


TABLE 4  
 FORMALDEHYDE AND 4-PC LEVELS IN SELECTED ROOMS  
 MAY THRU NOVEMBER 1988

Room	Carpet Laid	Formaldehyde (ppb)			4-Phenylcyclohexene (ppb)			
		May	June	Nov.	May	June	Aug.	Nov.
SE-216	none	NS	NS	NS	.04-.2	NS	NS	NS
SE-226	4/88	<4	NS	NS	3.7-6.7	0.8	0.2	NS
SE-274	4/88	7-49	NS	ND-20	0.7-1.3	NS	NS	.07
M-2710	none	ND-59	2.4	ND	ND	ND	ND	ND
M-2708.5	unk.	<4-37	NS	NS	2.6-3.9	0.6	NS	NS
M-2827	3/88	ND-46	NS	ND	0.4	NS	NS	ND-0.1
M-3304	none*	<4	NS	NS	0.2	NS	NS	NS
M-3241	4/88	6-59	NS	NS	1.7-1.8	ND	NS	NS
E-1015	none	<4	NS	NS	.03-0.3	NS	NS	NS
E-935	4/88	<4	NS	NS	0.6-0.9	NS	NS	NS

\* Carpet laid across the hall, M-3305 in 3/88

ND = not detected

NS = present, but not quantifiable

TABLE 5  
VOLATILE ORGANICS IN SELECTED ROOMS

Room	Carpet	Compound in ppb					
		CH <sub>2</sub> Cl <sub>2</sub>		1,1,1-Cl <sub>3</sub> C.H.		C.H.	
		May	Nov.	May	Nov.	May	Nov.
SE-216	none	.04-1.7	NS	.2-6.3	NS	.1-0.8	NS
SE-226	4/88	2.1-4.9	NS	1.1-5.8	NS	.6	NS
SE-274	4/88	ND-1.1	.9-4.5	.5-3.	.3-1.9	.3-.5	.5-1.2
M-2710	none	.3	.9-8.	.3-3.3	.5-1.	ND	.6-1.1
M-2708.5	unk	1.9-2.1	NS	.2-1.	NS	NQ-.2	NS
M-2827	3/88	1.2-6.3	1.5-8.9	.5-3.	.3-1.7	.3-.8	.6-.7
M-3304	none*	1.4-2.6	NS	1.7-12	NS	.3-.8	NS
M-3241	4/88	.4-1.3	NS	.3-5.1	NS	.1-.2	NS
E-1015	none	.3-9.1	NS	.3-4.	NS	.1	NS
E-935	4/88	.5	NS	.2-.3	NS	.02-.1	NS

\*Carpet laid across the hall in M-3305, 3/88

ND = not detected

NS = not sampled

NQ = present, but not quantifiable

TABLE 4

FORMALDEHYDE AND 4-PC LEVELS IN SELECTED ROOMS  
MAY THRU NOVEMBER 1988

Room	Carpet Laid	Formaldehyde (ppb)			4-Phenylcyclohexene (ppb)			
		May	June	Nov.	May	June	Aug.	Nov.
SE-216	none	NS	NS	NS	.04-.2	NS	NS	NS
SE-226	4/88	<4	NS	NS	3.7-6.7	0.8	0.2	NS
SE-274	4/88	7-49	NS	ND-20	0.7-1.3	NS	NS	.07
M-2710	none	ND-59	2.4	ND	ND	ND	ND	ND
M-2708.5	unk.	<4-37	NS	NS	2.6-3.9	0.6	NS	NS
M-2827	3/88	ND-46	NS	ND	0.4	NS	NS	ND-0.1
M-3304	none*	<4	NS	NS	0.2	NS	NS	NS
M-3241	4/88	6-59	NS	NS	1.7-1.8	ND	NS	NS
E-1015	none	<4	NS	NS	.03-0.3	NS	NS	NS
E-935	4/88	<4	NS	NS	0.6-0.9	NS	NS	NS

\* Carpet laid across the hall, M-3305 in 3/88

ND = not detected

NS = present, but not quantifiable



TABLE 5 CONTINUED

Room	Compound in ppb					
	Xylenes*		Styrene		Other VOCs**	
	May	Nov.	May	Nov.	May	Nov.
SE-216	.9-2.5	NS	.2-.9	NS	4-22	NS
SE-226	2-2.3	NS	.2-.3	NS	37-52	NS
SE-274	2.6-3.7	1.3-3.3	.5-.6	NQ-.3	36-41	14-52
M-2710	2.1-3.2	.6-1.7	.3-.5	NQ-.3	12-13	10-38
M-2708.5	1.3-3.4	NS	.2-.5	NS	48-54	NS
M-2827	2-4	1.4-2	.4	ND-NQ	15-182	8-32
M-3304	2.6-2.7	NS	.3	NS	70-161	NS
M-3241	3.1-3.5	NS	.5-.6	NS	31-40	NS
E-1015	1.4-3.2	NS	.1-.4	NS	14-49	NS
E-935	2.4-4.2	NS	.5	NS	35-43	NS

\* Includes ethylbenzene

\*\*Chiefly unspecified alkanes, alcohols, and < 5 ppb acetone

TABLE 5 CONTINUED

Room	Compound in ppb							
	CH <sub>2</sub> ClCH <sub>2</sub> Cl		CHClCCl <sub>2</sub>		C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>		CCl <sub>2</sub> CCl <sub>2</sub>	
	May	Nov.	May	Nov.	May	Nov.	May	Nov.
SE-216	ND	NS	ND	NS	1.3-2.9	NS	.2-.5	NS
SE-226	ND	NS	.1	NS	4.9-11	NS	.6-.9	NS
SE-274	ND	ND-.4	ND-.1	NQ-.3	4.3-5.9	1.7-4.3	.8	ND-1
M-2710	ND	ND-.6	ND	ND-.3	.3-10	1.3-3	1.3-5	NQ-.4
M-2708.5	ND-NQ	NS	ND-.1	NS	3-6.7	NS	1-5.3	NS
M-2827	ND	ND-.7	ND	ND-.4	.1-3.1	1.8-3	.4-.6	NQ-.9
M-3304	ND-.1	NS	.03-.1	NS	5-8.7	NS	1.2-13	NS
M-3241	ND	NS	ND-.1	NS	.6-8.9	NS	.1-1.5	NS
E-1015	ND	NS	ND-.3	NS	.7-4.7	NS	.7-.8	NS
E-935	ND	NS	ND	NS	5.7-5.8	NS	.8	NS

RECOMMENDED INDOOR AIR STANDARD FOR  
4-PHENYLCYCLOHEXENE

TO PROTECT AGAINST INDUCTION OF MULTIPLE CHEMICAL SENSITIVITY

Lowest Observed Effect Level = 5 ppb

Factor to derive No Observed Effect Level = 10

Factor to account for more sensitive individuals = 10

Factor to account for uncertainty re: cumulative dose effects,  
actual LOEL and severity of multiple chemical sensitivity effect  
= 10

DERIVED INDOOR AIR STANDARD = .005 PPB

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TO PROTECT AGAINST ACUTE IRRITANCY EFFECTS

Lowest Observed Effect Level = 5 ppb

Factor to derive No Observed Effect Level = 10

Factor to account for more sensitive individuals = 10

Factor to account for uncertainty in LOEL, lesser severity of  
irritancy compared to MCS = 3

DERIVED INDOOR AIR STANDARD = .017 PPB

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In addition to the indoor air standard, we recommend, via a TSCA section 21 petition that: 1) testing be required on finished latex and carpeting to establish a product-content standard for 4-PC that will assure compliance with the indoor air standard; 2) quality control records be maintained and procedures put in place to assure compliance with product content standards; and 3) notification be given of the risks associated with 4-PC levels above those specified in the standards; and 4) products containing 4-PC at levels greater than the standards be re-called.

We do not contend that 4-PC is the cause of every case of MCS, nor do we contend that all carpet or all styrene-butadiene latex is hazardous, nor that these products cannot be manufactured, sold and used safely. We do contend that under the conditions existing at WSM in the time period in question, exposure to 4-PC at levels of ca. 10 ppb resulted in induction of MCS and irritancy responses in EPA employees.

## DATA SOURCES AND PERTINENT LITERATURE

### Exposure Data:

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3. A Final Summary Report on the Indoor Air Monitoring Performed at USEPA Headquarters, Washington, D.C. on March 4 and 5, 1988. Singhvi, R., Turpin, R.D., and Burchette, S.M. U.S. EPA, Edison, NJ. August 18, 1988.
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6. Identification and Characterization of 4-Phenylcyclohexene--An Emission Product from New Carpeting, FYI Submission No. OTS-0288-0596 to U.S. EPA, Washington, DC. January 8, 1987.

### EPA Employee Injury Data:

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### Multiple Chemical Sensitivity:

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6. Toxic Carpet II. Beebe, G. Available through Glen Beebe, c/o Toxic Carpet, P.O. Box 399086, Cincinnati OH 45239.

Structure-Activity Relationships: 4-PC and Cyclohexene:

The following are exemplary of 30 references cited on TOXLINE.

1. The Significance of Multiple Detoxification Pathways for Reactive Metabolites in the Toxicity of 1,1-Dichloroethylene. Anderson, M.E., Thomas, O.E., Gargas, M.L., Jones, R.A., Jenkins, L.L. Toxicol Appl. Pharmacol. 52, 422-432, 1980.
2. Excretion of Methyl Mercury in Rat Bile: the Effect of Diethyl Maleate, Cyclohexene Oxide and Acrylamide. Refsvik, T. Acta Pharmacol. Toxicol. 42, 135-141, 1978.
3. Isolation and Characterization of an Active DNA-Binding Metabolite of Benzo(a)pyrene from Hamster Liver Microsomal Incubation System. Wang, I.Y., Rasmussen, R.E., Crocker, T.T. Biochem. Biophys. Res. Commun. 49, 1142-1149, 1972.

Citizens' Complaints:

1. Telephone/Mail Logs of J. W. Hirzy, 1988-1989. 43 Phone calls, 4 letters involving 77 individuals self-reporting MCS, plus a clinical psychologist reporting "many patients" presenting with self-reported MCS.
2. The Reactor. Editor: Susan Malloy. P.O. Box 575, Corte Madera, CA 94925.
3. Responses to advertisements by G. and S Beebe. See above for contact address.



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