

**U.S. Department of Energy (DOE)**

**FORRESTAL BUILDING HEALTH CONCERN SURVEY**

An Evaluation of Employee Health Concerns at the DOE Forrestal Building\*

Conducted by the staff of the Office of Epidemiology and Health Surveillance (EH-53)

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\*This report contains an evaluation of health concerns among employees of an area of the DOE Forrestal Building. Any evaluations and recommendations made in the report are for the specific facility evaluated and may not be universally applicable. Recommendations made are not to be considered as final statements of DOE policy or of any other agency or individual involved. When finalized, this report will be made available on our web site at <http://www.eh.doe.gov/health/epi/surv/index.html>.

## **PREFACE**

The Office of Epidemiology and Health Surveillance conducts field investigations of potential health hazards in the Department of Energy (DOE) workplace. The office also provides, upon request, technical assistance and epidemiologic consultation to DOE Headquarters, Field Elements, and DOE contractors to facilitate the control of occupational health hazards, reduce risks to worker health and safety, and help to identify emerging occupational health issues through the conduct of health surveillance of the workforce.

## **ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT**

This report was prepared by Dr. Clifton Strader with assistance from Dr. Bonnie Richter and Ms. Jasmine Kenney of DOE Headquarters, and Dr. Betsy Dupree-Ellis of Oak Ridge Institute for Science and Education. Invaluable field assistance was provided by Ms. Cherylynn Williams, Safety & Occupational Health Manager, Office of Management, Budget and Evaluation (ME).

Copies of this report have been sent to employee and management representatives of ME. The report is also available on our Web site at <http://www.eh.doe.gov/health/epi/surv/index.html>.

## SUMMARY

In March 2004 the Safety & Occupational Health Manager, Office of Management Communications, contacted the Office of Epidemiology and Health Surveillance (EH-53) to request assistance in investigating an employee health concern. Employees located in offices along the Department of Energy Forrestal Building's northeastern end GA and GB corridors had reported ongoing concerns with a variety of health issues, primarily respiratory in nature, which they believed were being caused by air quality problems in the building. EH-53 staff conducted a site walk-through in May 2004 and discussed the issues with management and labor representatives. An employee survey was conducted in the same month, with questionnaires circulated to 73 employees in the affected area.

Response to the survey was 56 percent, a response rate that significantly restricted the ability to interpret the findings based on the data received. In addition, we were unable to acquire any industrial hygiene measurements to evaluate the air quality and condition of the ventilation system over the time period of interest. Our evaluation indicated that a number of respiratory symptoms were associated with office environmental conditions as reported by respondents. Further, some problems appeared to be specific to one corridor, as in the case of ongoing temperature regulation concerns affecting the GA corridor. Ventilation problems, inadequate temperature regulation, drafts, and unusual odors were frequent complaints associated with a spectrum of symptoms.

The limited data offer equally limited statistical assurance of a relationship between the building's air quality and ongoing respiratory concerns of the employees. However, our findings were sufficiently consistent to suggest that increased periodic industrial hygiene monitoring and ongoing employee input could assist in attaining a satisfactory level of air quality in the northeastern wing GA-GB corridor area. Regular inspection of ventilation ducts; consistent, accessible industrial hygiene recordkeeping; and the potential value of reviewing and implementing, where necessary, the workplace air quality guidance issued by the U.S. Environmental Protection Agency all could potentially contribute to an improved work environment. We also strongly recommend continued employee involvement in the monitoring process, as their input can help with early identification of problems and offer a useful measurement of the quality of their work environment.

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# FORRESTAL BUILDING HEALTH CONCERN SURVEY

## INTRODUCTION

The Safety & Occupational Health Manager, Office of Management Communications (ME-43), contacted the Office of Epidemiology and Health Surveillance (EH-53) in March 2004 to request assistance in investigating a worker health concern. A number of workers in offices located in the GA and GB corridors of the northeastern wing basement floor of the Department of Energy (DOE) Forrestal Building had expressed concern about the potential health impact of their working environment. Of particular concern were a number of respiratory symptoms, such as severe bronchitis that workers believed to be related to the office environment. Five cases complained of a similar respiratory syndrome involving persistent cough and congestion. Most had seen a physician about their condition. The symptoms had been present since November 2003 and reported to EH-53 about six months later. Management's concern was whether the work environment had impaired employee health and whether the symptoms reported by the index cases were actually more widespread but unreported for other workers.

## BACKGROUND

The U.S. Environmental Protection Agency (EPA) notes that sick building syndrome (SBS) is "used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified" (1991). SBS has been recognized since the 1970s and has often been viewed as the result of the growing construction of and conversion to more energy efficient workplaces (Redlich, Sparer, Cullen, 1997). Although there is no single, generally accepted definition of SBS and its symptoms, there are symptoms that are frequently associated with SBS. These symptoms are nonspecific and are predominantly upper respiratory in origin (Niven, Fletcher, Pickering, Faragher, Potter, Booth, Jones, Potter, 2000). Common symptoms include:

- Mucous-membrane irritation; e.g., eye irritation, throat irritation, cough;
- Neurotoxic effects; e.g., headaches, fatigue, lack of concentration;
- Respiratory symptoms; e.g., shortness of breath, cough, wheezing;
- Skin symptoms; e.g., rash, itching, dryness; and
- Chemosensory changes; e.g., enhanced or abnormal odor perception, visual disturbances (Redlich, Sparer, Cullen, 1997).

The majority of studies conducted to ascertain the causes have found a number of common causes. The most frequently noted cause is inadequate ventilation. Many buildings rely solely on heating, ventilation, and air conditioning (HVAC) systems to distribute air. If these systems are not working properly, the amount of outside air may be too low to maintain the health and comfort of the building's workers (U.S. EPA, 1991). While the ventilation system may contain no contaminants that might produce the symptoms being reported, it may simply be inefficient, providing insufficient or unevenly distributed airflow.

Volatile organic compounds (VOCs) found in the workplace have also been cited as a cause. VOCs are low-level chemical emissions that may come from many sources, such as insulation, machines, carpeting, adhesives, photocopiers, and cleaning agents (Thorn, 2002; U.S. EPA, 1991). Another cause is biological contaminants including bacteria, molds, pollens, and viruses. These contaminants may be present in buildings as a result of high levels of humidity, standing water, and leaks (U.S. EPA, 1991). Psychosocial factors such as job dissatisfaction and unsatisfactory job location may also underlie such complaints (Thorn, 2000).

## **METHODS**

EH-53 staff conducted a walk-through of the workspace on May 4, 2004, which revealed a windowless area on the ground floor at the northeastern end of the Forrestal Building housing an estimated 73 representatives of the Office of Environment, Safety and Health (EH); the National Nuclear Security Administration (NA); and the Office of Management, Budget and Evaluation (ME). The employees' offices were located along and between the GA and GB corridors (see map in Appendix A) at the northeastern end of the building. As Appendix A shows, the distribution of workers from various offices did not completely locate members of a given office within adjacent office space.

Complaints of respiratory symptoms in an office environment most often suggest the need to assess air quality. ME indicated that periodic industrial hygiene (IH) testing of the ventilation system had been conducted over time. Our point of contact relayed that recent testing had not identified any significant contamination within the system. Prior episodes of dampness or mold in the office spaces had been resolved. Despite repeated requests, we were not able to acquire copies of the IH test results for this review.

A questionnaire was developed to survey the extent of symptoms among the staff. The questionnaire (Appendix B) contained questions concerning current and past work locations, duration of employment, a medical history focused on history of respiratory and allergic complaints, questions concerning whether particular symptoms were experienced primarily at work or elsewhere, and a tobacco use history. Employee participation in the survey was voluntary and response anonymous. The questionnaire, with an explanatory cover letter (Appendix C), was distributed either directly or through office management to each of 73 workers in the GA/GB corridor area on May 4, 2004. Instructions stated that the completed questionnaire should be returned to EH-53 by May 14. A followup letter providing additional information on the assessment and urging workers to participate was sent to management for approval and distribution to employees on May 5. In subsequent conversations with Forrestal management, we requested that supervisors of the affected workers encourage their workers to participate. The subsequent slow rate of return of completed questionnaires prompted us to extend the period of acceptance through the end of May 2004.

Copies of the returned surveys were redacted to remove any potentially identifying information to protect worker privacy, in accord with the requirements established by the Oak Ridge Institute for Science and Education's (ORISE) Internal Review Board. These copies were sent to ORISE for data entry and analysis. The analyses were further reviewed and interpreted by DOE Headquarters EH-53 staff.

Objectives of the analysis were:

- To describe the sample of workers who responded to the survey;
- To identify pre-existing conditions that might have complicated interpretation of the responses to questions about the workplace environment;
- To assess the employees' responses to the workplace conditions of concern in light of both the building location in which they work and the organization for which they work; and
- To identify whether an association existed between any symptoms and building conditions.

## **EVALUATION CRITERIA**

This assessment relied upon voluntary responses to a survey addressing respondents' recent health concerns, nonoccupational exposures, and potential recent exposures in their workplace. Statistical testing was conducted to identify and measure the strength of potential associations among these factors. Much of the analysis focused on the identification of these relationships. No directly measured IH data were made available for this survey. In the absence of such data, reported symptoms and indications of possible environmental exposures were assessed. The evaluation also considered an assessment of consistency of the relationships reported; i.e., the presence of numerous symptoms that might reasonably suggest that a potential risk factor were present in the work environment.

To evaluate the many comparisons involved in this assessment, we used Fisher's Exact Test of association, a statistical test often used to determine whether a relationship between two factors is probable when the number of respondents is very small (Fleiss, 1981). Customarily, a significance value, or "p-value" of less than or equal to .05 is considered to indicate a statistically significant relationship, unlikely to be due to chance. The smaller the p-value, the less likely a relationship is due to chance. However, the reader is cautioned that, despite the appearance of statistical significance for many of the relationships we examined, the fact that many tests were conducted might have identified some apparently significant relationships which are, in fact, due to chance.

## **RESULTS**

### Response rate

Forty-one of the 73 employees returned a completed survey; a response rate of 56 percent. Because the identity of respondents was not determined, we were unable to evaluate how employees who responded to the survey might have differed from those who did not respond.

### Characteristics of the respondents

Respondent characteristics (questions 1–11) are presented in Figure 1. Thirty-nine of the respondents had offices on either of two corridors, GA or GB. The other two respondents were located in the GE and GP areas. Eight of the respondents worked for EH, and most of them (7/8, 88 percent) were clustered along GA corridor. Ninety-three percent of the 15 ME employees occupied the GB corridor. By contrast, the 18 NA employees were more widely distributed, with

two-thirds in offices on GA corridor, 22 percent on GB corridor, and 2 employees in the GP and GE areas.

The duration of employees in their current office ranged from a matter of weeks to 25 years. Sixty-seven percent of ME employees had spent 5 or fewer years in their current offices. NA employees were relative newcomers, all reported 5 years or less in their current offices. Six of the 8 EH employees had been in their current offices for 5 or more years. Overall, 10 of the 13 workers (77 percent) who reported occupying their current offices less than 1 year were located on the GA corridor.

Figure 1. Characteristics of Forrestal survey respondents

Characteristic	Number of respondents	Distribution
Gender:		
Male	30	73%
Female	11	27%
Age Group		
<35	7	17%
35-44	7	17%
45-54	16	39%
55+	11	27%
Average Age:	41	48 years
Federal or Contractor:		
Federal	29	71%
Contractor	12	29%
Organization:		
Environment, Safety and Health (EH)	8	20%
Management, Budget and Evaluation (ME)	15	37%
National Nuclear Security Administration (NA)	18	44%
Office Location (corridor):		
GA	20	49%
GB	19	46%
Other	2	5%
Years in current office:		
≤ 1 year	13	32%
>1-5 years	18	44%
>5-10 years	4	10%
>10 years	6	14%
Average time in current office:	41	4.5 years
Average years worked at DOE:	41	14.3 years

Two-thirds of the respondents were aged 45 years or older, but the age distribution varied somewhat by organizational affiliation. Respondents from ME had a somewhat younger age distribution than did EH or NA respondents. While 88 percent (7/8) of EH workers and



72 percent (13/18) of the NA respondents were 45 or older, 47 percent (7/15) of the ME respondents were 45 or older.

Current symptoms

Respondents were asked whether or not they had recently experienced a number of symptoms (Figure 2, question 18). We evaluated these symptoms in relation to potential exposures in the office environment, organizational affiliation, and room occupancy along a particular office corridor. Twenty respondents (49 percent) reported at least one of these symptoms. Nasal congestion and runny nose were the most frequently reported “often experienced” symptoms, each being reported by 24 percent of the respondents. The age of the respondents was not significantly associated with any of the reported symptoms. The relationships between various office conditions and nonoccupational exposures and the symptoms in Figure 2 are presented with the discussions of the individual exposures elsewhere in this report.

Figure 2. Distribution of recent symptoms.

<b>Symptom</b>	<b>How often experienced</b>	<b>Number of Respondents</b>	<b>Percent Distribution*</b>
Persistent cough	Often	5	12
	Rarely	15	37
	Never	16	39
	No response	5	12
Shortness of breath	Often	1	2
	Rarely	8	20
	Never	24	59
	No response	8	20
Tightness in chest	Often	1	2
	Rarely	9	22
	Never	23	56
	No response	8	20
Wheezing	Often	2	5
	Rarely	9	22
	Never	22	54
	No response	8	20
Lung rattle	Often	0	0
	Rarely	8	20
	Never	26	63
	No response	7	17
Sneezing	Often	6	15
	Rarely	18	44
	Never	10	24
	No response	7	17
Runny nose	Often	10	24
	Rarely	14	34
	Never	10	24
	No response	7	17

<b>Symptom</b>	<b>How often experienced</b>	<b>Number of Respondents</b>	<b>Percent Distribution*</b>
Stuffy nose	Often	10	24
	Rarely	17	41
	Never	7	17
	No response	7	17
Rhinitis	Often	4	10
	Rarely	8	20
	Never	21	51
	No response	8	20
Persistent sore throat	Often	0	0
	Rarely	8	20
	Never	24	59
	No response	9	22
Hoarse	Often	1	2
	Rarely	15	37
	Never	18	44
	No response	7	17
Fever	Often	0	0
	Rarely	7	17
	Never	26	63
	No response	8	20
Chills	Often	2	5
	Rarely	5	12
	Never	26	63
	No response	8	20
Body aches	Often	1	2
	Rarely	9	22
	Never	23	56
	No response	8	20
Headache	Often	5	12
	Rarely	13	32
	Never	15	37
	No response	8	20
Eye problems	Often	7	17
	Rarely	9	22
	Never	18	44
	No response	7	17
Swelling eyelids	Often	0	0
	Rarely	9	22
	Never	24	59
	No response	8	20
Contact lens problems	Often	0	0
	Rarely	6	15
	Never	24	59
	No response	11	27

Symptom	How often experienced	Number of Respondents	Percent Distribution*
Rash	Often	3	7
	Rarely	6	15
	Never	24	59
	No response	8	20
Nausea	Often	0	0
	Rarely	3	7
	Never	30	73
	No response	8	20
Dizzy	Often	2	5
	Rarely	9	22
	Never	22	54
	No response	8	20
Nervous	Often	4	10
	Rarely	11	27
	Never	18	44
	No response	8	20
Other symptoms	Often	1	2
	Rarely	1	2
	Never	4	10
	No response	35	85

\* Percentages may not total to 100 percent due to rounding.

### Workplace conditions

Questions 12-17 addressed office environmental conditions. Three of the 41 respondents gave a negative reply to all questions addressing potential exposures in the office environment. Most respondents noted at least 1 office environmental condition, and 46 percent (19/41) reported 3 or more conditions. The age of the respondents was not associated with any of the reported office conditions.

Figure 3 shows the distribution of positive responses to questions concerning office environmental conditions; ranked from highest to lowest by the percentage of respondents who *ever noticed* the condition (questions 12-17, Appendix B). We found that temperature control (78 percent) and ventilation (66 percent) were the most common problems ever noticed by respondents. Of those who reported temperature control problems, half (n=16) reported that the problem exists currently, as did 70 percent (n=19) of the respondents who reported ventilation problems. Drafty conditions were reported by 11 of the respondents, 8 of whom (73 percent) noted that the conditions still exist.

Figure 3: Office environmental conditions reported by respondents

<b>Office condition</b>	<b>Number of respondents reporting condition ever noticed</b>	<b>Percentage of respondents reporting condition ever noticed</b>	<b>Percentage of respondents reporting that condition also exists currently</b>
Poor temperature control	32	78	50
Poor ventilation	27	66	70
Dampness or wet areas	18	44	28
Unusual odor	17	41	18
Drafts	11	27	73
Mold or mildew	7	17	43

*Temperature regulation*

Temperature regulation (question 17) was a problem on both corridors, but especially on GA corridor, where 95 percent of the 20 respondents reported that temperature regulation had been deficient at one point or another. Fifty-eight percent of the GB residents agreed. The difference between the two corridors was statistically significant ( $p=0.008$ ). Nineteen of 20 (95 percent) residents of the GA corridor identified temperature regulation as a problem, but only 11 of 19 (58 percent) GB corridor residents reported temperature problems. The two employees in other locations also reported temperature problems. In our combined analysis of organization and corridor occupancy, we found that ME respondents, regardless of corridor, were less concerned with poor temperature regulation than were EH or NA respondents ( $p=.005$ ). Wheezing was the only statistically significant health condition associated with temperature regulation concerns ( $p=.01$ ).

*Ventilation*

Clearly, ventilation (question 15) was a problem at one time or another on both GA and GB corridors, with two thirds of the respondents reporting a history of ventilation problems. A slightly higher percentage of GB residents reported ventilation problems, but the difference between corridors wasn't significant ( $p=0.50$ ). Of some interest was the fact that 19 of the 27 (70 percent) respondents who reported ever detecting ventilation problems noted that these problems were ongoing currently. In our comparison of workplace conditions with recently reported medical symptoms, ventilation problems appeared related to persistent cough ( $p=.03$ ), runny nose ( $p=.01$ ), and were most strongly associated with nasal congestion ( $p=.0004$ ).

*Dampness*

Eighteen workers (44 percent) reported ever having problems with dampness (question 13). The problem was most apparent among ME workers, 60 percent (9) of whom reported damp conditions, and NA workers, 39 percent (7) of whom reported dampness. Only two of the eight EH respondents noted this concern.

Differences in dampness occurrence were not significantly different by corridor of occupancy ( $p=.34$ ). Five of the 18 respondents (28 percent) who reported ever experiencing damp conditions at work noted that the dampness was ongoing currently. Dampness was associated with a number of recent medical symptoms, including lung rattle ( $p=.01$ ), rhinitis (inflammation of the nasal passages,  $p=.03$ ), sneezing ( $p=.01$ ), and eye problems ( $p=.02$ ).

### *Odors*

Overall, 41 percent of the respondents had noted unusual or odd odors (question 14). About the same percentage of workers in each organization had noted unusual odors: 37 percent of EH respondents, 33 percent of ME, and 50 percent of NA respondents reported concerns about this office condition. We found suggestive evidence that the GB corridor was somewhat more affected (53 percent of GB respondents versus 25 percent of GA workers,  $p=.11$ ). Only 3 people reported smelling a strange odor currently; the other 14 were among the “ever noted an odd odor” group, suggesting that odors are unlikely to be a current problem of broad importance. Nonetheless, the detection of odors was reportedly associated with far more medical symptoms than was any other exposure in the office environment. A history of odors was associated with persistent cough ( $p=.00007$ ), shortness of breath ( $p=.01$ ), wheezing ( $p=.02$ ), lung rattle ( $p=.01$ ), sneezing ( $p=.001$ ), nasal congestion ( $p=.04$ ), rhinitis ( $p=.005$ ), sore throat ( $p=.0003$ ), fever ( $p=.0008$ ), and chills ( $p=.02$ ).

### *Drafty conditions*

About 26 percent of the respondents noted drafty conditions (question 16) in their offices, making this one of the more commonly cited office environmental concerns. We found no difference in the frequency of this condition between the GA and GB corridors ( $p=.48$ ). Recent health conditions such as lung rattle ( $p=.03$ ), sore throat ( $p=.02$ ), and chills ( $p=.008$ ) were associated with drafty conditions.

### *Mold and mildew*

Seven workers reported ever having a mold or mildew problem (question 12: 3 ME, 4 NA), demonstrating no difference in occurrence by organization. We also found no difference associated with corridor of occupancy. A history of mold or mildew was associated with sneezing ( $p=.006$ ), nasal congestion ( $p=.04$ ), rhinitis ( $p=.03$ ), and headache ( $p=.02$ ).

### Pre-Existing Health and Exposure Conditions

Several sets of questions addressed nonoccupational conditions that could affect the responses to current office conditions:

- pre-existing medical conditions of the workers (questions 19-21);
- residential exposures to chemicals (questions 22-24); and
- smoking and exposure to tobacco smoke (questions 25-27).

Questions 19, 20, and 21 addressed pre-existing medical conditions ever diagnosed by a physician that could affect a person’s response to the environmental office conditions included in

the survey (i.e., questions 12-17). Question 19 asked about the presence of 20 different medical conditions diagnosed by a physician and evaluated whether these conditions had existed before the respondent moved into his or her current office. Twenty-five workers (61 percent) reported that they had none of the conditions. Of the 16 workers who reported having at least one of the medical conditions, only 9 individuals reported developing the condition after taking occupancy of their current office (Figure 4). Three of these nine respondents reported two conditions; one involving bronchitis and cough, another reporting rhinitis and eye irritation, and the third reporting rhinitis and sinusitis. All three of the respondents reported chronic bronchitis developing after they had moved into their current offices in the GB corridor, but this association was not statistically significant ( $p=.11$ ). Overall, we found no compelling evidence that any of the 20 medical conditions ever diagnosed by a physician were associated with a particular corridor, organization, office environmental condition, or gender of the respondents.

Figure 4. Medical conditions first noted after occupancy in current office

Medical Condition	Number of Respondents
Chronic bronchitis	3
Rhinitis	3
Chronic sinusitis	1
Chronic cough	1
Rash, hives, or skin irritation	1
Eye irritation	1
Dizziness	1
Numbness or prickling feeling in hands or feet	1

Nineteen workers (46 percent) reported having received an allergy diagnosis from a physician (question 20), but we found no association between having an allergy and occupancy on a particular corridor or gender. Rarely or often wheezing (question 21) was significantly associated with working in EH ( $p=.01$ ). Seventy-one percent of EH respondents reported rarely or often wheezing, compared with 30 percent of ME respondents and 19 percent of the NA respondents. Having an allergy diagnosis was not associated with wheezing ( $p=1.0$ ). Nineteen workers gave a positive response to at least one part of our query about a history of wheezing, but the 19 people who reported a physician’s diagnosis of an allergy were not all the same 19 people who said they had a history of wheezing.

### *Allergy*

The occurrence of allergies (question 20) was not significantly different by organization, but all of the NA respondents who reported allergies noted that these were outdoor allergies, whereas all of the EH and ME respondents with allergies reported allergies that tend to be associated with indoor exposures. The difference was not significant ( $p=0.17$ ). We found no indication that allergy diagnoses were more common on one corridor than on the other ( $p=.46$ ).

### *Wheezing*

We found no significant difference in the prevalence of wheezing symptoms by organizational category (question 21,  $p=0.66$ ). However, a high percentage of workers in each organization reported a history of ever having wheezing symptoms: 63 percent of EH, 40 percent of ME, and 44 percent of NA respondents reported a history of wheezing. Occasional wheezing was common on both GA and GB corridors (40 percent versus 53 percent of the respondents); there was no statistically significant difference in its occurrence ( $p=.53$ ).

### *Nonoccupational exposures*

Seven workers reported that they had at least one recent residential chemical exposure: pesticides, use of an exterminator service, or use of a chemical lawn service (questions 22-24). These recent exposures were not associated with occupancy in either corridor ( $p=1.0$ ) or with organizational affiliation ( $p=.75$ ). Women were somewhat more likely than men to report a nonoccupational exposure (36 percent vs. 10 percent,  $p=.07$ ). This relationship was consistent, although not statistically significant, for each of the three types of nonoccupational exposure. None of the nonoccupational exposures were statistically significant related to wheezing ( $p=1.0$ , Question 21) or to any other recent symptoms reported in question 18.

### *Tobacco use*

Exposures to both direct and secondhand tobacco smoke were addressed in questions 25 through 27. Forty-six percent (19) of the respondents had ever smoked tobacco. Six additional respondents noted that they had been exposed only to secondhand tobacco smoke. We found noticeable differences by organization. EH had the highest percentage of workers who had ever smoked (75 percent), ME was intermediate (53 percent), and NA had the fewest ever-smokers (28 percent), but the difference was not statistically significant ( $p=.10$ ). This distribution could not be explained by age differences; EH and NA have an older age distribution than does ME, but NA had the lowest percentage of respondents who ever smoked tobacco. Men were significantly more likely to have ever smoked (73 percent ever smoked) than women (27 percent,  $p=.03$ ).

Although having ever smoked appeared somewhat related to organization, we found no evidence of a “smoking corridor” ( $p=.20$ ). In fact, the percentage who had ever smoked was similar for GA and GB corridors. The experience of secondhand smoke was more common on GB (26 percent,  $n=5$ ) than on GA (5 percent,  $n=1$ ). A history of having ever smoked was significantly associated with headache ( $p=.02$ ) and sore throat ( $p=.04$ ).

## **DISCUSSION AND CONCLUSIONS**

The interpretation of these results must consider a number of limitations, chief of which was a very poor response rate. Most epidemiologic assessments strive for a response rate of at least 80 percent; i.e., at least 80 percent of the potential respondents actually submit answers to the questions. The response rate in this review was 56 percent, well below the level at which we feel confident in interpreting the results.

Our inability to identify the respondents and compare them with nonrespondents provides no way to determine whether the sample who answered our questions was in some way unrepresentative of the 73 employees to whom we distributed a questionnaire. It is possible that staff members with ongoing health concerns were more likely to respond to our survey than were other employees, which would, in turn, over-represent the prevalence of health conditions and health concerns among the group as a whole.

An additional concern was the lack of industrial hygiene monitoring data available to us, despite several requests for any available monitoring records. Such data would have provided a foundation for quantifying the level of any likely exposures and might have shed light on potential deficiencies in the ventilation system that could plausibly have resulted in the types of symptoms reported by respondents. Without such data, we were forced to assess indirect and perhaps more subjective surrogates for exposure, such as corridor of occupancy and the detection of suspicious odors.

We emphasized statistical significance testing to identify those relationships most likely to be true associations; i.e., those not due to chance. However, in such a small sample of respondents it is entirely possible that some associations of importance were not detected. We also looked for patterns and consistency in the responses that were not necessarily statistically significant. For example, we noted that women were more likely to report a history of recent exposure to all three nonoccupational exposures on which we queried. Though consistent, the relationship with gender was not statistically significant.

Respondents noting office exposures *ever* experienced most often cited ventilation and temperature concerns, but *current* concerns focused on poor ventilation and drafts. With 19 of the 27 respondents who reported ever detecting a ventilation problem also reporting that the problem is still present, it is difficult to ignore the likelihood that this area of the Forrester Building may have ongoing ventilation deficiencies or have ventilation perceived by many as inadequate. The problem was not linked to one corridor. Persistent cough, runny nose, and nasal congestion were all significantly associated with ventilation problems.

Having ever noticed temperature control problems was cited by 78 percent of the respondents; half of these respondents reported that these problems exist currently. Temperature regulation was a particular problem on GA corridor, where 95 percent of the respondents noted its presence at some point in time. On GB corridor, 58 percent of the respondents agreed, a statistically significant difference. It is possible that temperature control has either improved or that respondents have become more accustomed to this aspect of the work environment. Another possibility is that some respondents simply entered responses to the first part of this multipart question and passed over the other sections, which focused on whether the concern was current or had ever arisen in the past. Both EH and NA respondents were more concerned with temperature regulation than were ME respondents. Wheezing was the only health condition significantly associated with this exposure.

Five of the 18 respondents who cited dampness as a concern reported that it is ongoing. Workers in ME were most concerned, and both corridors were involved. Dampness was significantly



associated with a variety of recent medical symptoms, including lung rattle, rhinitis, sneezing, and eye problems.

Odors were associated with the broadest range of symptoms, but the underlying reason is not clear. It is possible that higher awareness rather than true seriousness of exposure is involved. Workers on GB corridor appeared somewhat more affected than GA workers, but not statistically significant. Only 3 people reported smelling a strange odor currently, the other 14 were among the “ever noted an odd odor” group, suggesting that odors are not a major problem currently. Even so, unusual odors were significantly associated with far more medical symptoms than was any other exposure in the office environment. Persistent cough, shortness of breath, rhinitis, nasal congestion, fever, lung rattle, sore throat, wheezing, sneezing, and chills were all cited prominently. The variety of symptoms linked with reports of odors suggest a possible exposure of real importance, but without appropriate air quality monitoring data it is impossible to clarify what sort of exposure might have occurred or when it occurred. Alternatively, it is possible that the perceived importance of odors relates to their “intrusiveness”; i.e., their likelihood of being noticed, rather than their significance as a real threat to health, but our survey yielded no information that could address this possibility.

Other office conditions included drafts, which were mentioned by about one-fourth of the respondents, with corridor of occupancy unrelated to the frequency of the complaint. Lung rattle, sore throat, and chills were significantly associated conditions. Less common than drafts, a history of mold and mildew problems was associated with sneezing, nasal congestion, and headache. It was not a corridor-specific problem.

Overall, ventilation problems, inadequate temperature regulation, and drafts were frequent complaints associated with a number of symptoms. Odors were also allied to a number of health issues. Despite these associations, a number of which were statistically significant, there was little consistent evidence of the involvement of a specific corridor with most of the problems in the work environment. Age was not a factor in reporting health complaints; younger respondents were as likely to cite health concerns as were older respondents. We also found little consistent evidence of a particular organization reporting a disproportionate share of the health concerns or environmental conditions. These observations offer a plausible argument that inadequacies in ventilation of the GA and GB corridor area of the Forrestal Building could be related to a spectrum of respiratory health issues affecting workers in the area.

However, other observations lend little support to such an argument. Of all of the symptoms compared with the major office exposures, only nasal congestion improved upon leaving work. If office exposures were broadly related to a variety of symptoms, we might have expected improvement in some of the other potentially acute symptoms, such as headache, nasal discharge, and wheezing, upon leaving work. The lack of such relationships lends little support to a close association between the symptoms reported in Question 18 and the work environment conditions reported. We noted no significant differences between respondents who reported a chronic medical condition diagnosed before taking occupancy of the current office and those diagnosed after occupancy.

Our evaluation of nonoccupational exposures at home noted that women were somewhat more likely than men to have reported an exposure to pesticides, use of an exterminator, or use of a chemical lawn treatment service, but none of these exposures was significantly related to any of the recent symptoms reported by our respondents. We found no evidence that occupants of a particular corridor or members of a particular organization were more likely to have experienced these exposures.

Almost half of our respondents had ever smoked tobacco. The percentage varied by organization, but the percentage who had ever smoked was similar for GA and GB corridors. Men were three times more likely than women to have ever smoked. Despite the high percentage of respondents who had ever used tobacco, we found significant associations only with headache and sore throat.

Some of the symptoms experienced over the time period in question could also have been influenced by external conditions such as seasonal viral syndromes. For example, the Centers for Disease Control and Prevention has reported that after two consecutive, relatively mild influenza seasons, the United States experienced a much more severe flu season in 2002-2003. With two types of influenza virus circulating simultaneously, flu morbidity exceeded baseline levels over 9 consecutive weeks during November 2003 to January 2004. Nationwide, over 35 percent of the respiratory specimens tested were positive for influenza by the end of November 2003. Influenza syndrome commonly includes symptoms such as fever, cough, and sore throat (Centers for Disease Control and Prevention, 2004). Such outbreaks could have contributed to the symptoms reported by some respondents.

Overall, our limited consideration of nonoccupational influences provides no indication that external chemical exposures, such as pesticide and lawn care applications, were a significant factor in the symptoms reported by our respondents. Although it is plausible that an active influenza or other viral syndrome season could have influenced recent experience of respiratory and other symptoms, an assessment of such influences was beyond the scope of this evaluation.

We have noted suggestive evidence that problems with the ventilation and temperature regulation may be related to many of the symptoms reported by our respondents. Ventilation problems are an ongoing concern, and temperature regulation was mentioned by 78 percent of our respondents, with half of these individuals noticing the problem currently. Temperature regulation appears to be an especially important concern on the GA corridor, where 95 percent of the occupants reported this problem. Ongoing drafty conditions and significant associations of several symptoms with reports of unusual odors also suggest potential ventilation issues that need to be addressed. Lacking supporting industrial hygiene data and noting the disappointing response rate to the survey, the data available to us do not document definitively a relationship between the symptoms reported and the office environment concerns, but there is sufficient evidence to suggest a number of recommendations.

## **RECOMMENDATIONS**

Continued periodic evaluation and increased monitoring of the area's ventilation with employee input in the assessment of satisfactory airflow and temperature regulation is foremost among our

recommendations. While industrial hygiene monitoring can assess a number of factors related to the quality of the area's ventilation, employee input is also an essential "measurement" of the quality of the work environment.

Periodic inspections should include attention to whether ventilation ducts are clean and whether furniture or other objects may be blocking vents and impeding airflow.

In the absence of a well-adjusted HVAC system, pollutants and irritants may build up, increasing the likelihood of symptoms similar to those observed in this survey. Consistent industrial hygiene recordkeeping can also provide a basis for periodic review to identify whether problems recur following a seasonal or other pattern. These data are also essential in linking environmental conditions in the workplace with potential patterns in employee health concerns.

Any modifications made to increase energy efficiency of the HVAC system should evaluate the potential impact on air quality in the workplace. Employee health and productivity are important components in the consideration of these changes.

Airflow should be adjusted to reflect what is going on in the building. If activities such as construction or pesticide application are being undertaken, appropriate scheduling of these activities and ongoing monitoring of the ventilation system can minimize any impact on air quality.

We also suggest that management and an industrial hygienist review the guidance produced by the U.S. Environmental Protection Agency (1990) to note any actions which may have been overlooked. This outline is a concise overview of actions an employer can implement to resolve ongoing air quality problems and reduce the likelihood of their recurrence.

## REFERENCES

Niven, R.M., Fletcher A.M., Pickering, C.A.C., Faragher, E.B., Potter, I.N., Booth, W.B., Jones, T.J., Potter, P.D.R. (2000) Building sickness syndrome in healthy and unhealthy buildings: an epidemiological and environmental assessment with cluster analysis. *Occup Environ Med.* 2000 Sep;57(9):627-34.

Fisk, WJ. (2002) How IEQ Affects Health, Productivity. *ASHRAE Journal.* May, 2002:56-58.

Fleiss JL. (1981) *Statistical Methods for Rates and Proportions.* Second Edition. New York NY: John Wiley and Sons, Inc.

Greene, R.E., Casey, J.M., Williams, P.L. (1997) A Proactive Approach for Managing Indoor Air Quality. *Journal of Environmental Health.* 60(4): 15-20

Mikatavage, M.A., Rose, V.E., Funkhouser, E., Oestendad, R. K. et al. (1995) Beyond air quality – Factors that affect prevalence estimates of sick building syndrome. *American Industrial Hygiene Association Journal.* 56(11): 1141-1147

Redlich, C.A., Sparer, J., Cullen, M.R. (1997) Sick-building syndrome. *The Lancet*. 349: 1013-1016

Thorn, A. (2002) Methodologic Aspects of the Study of Modern-Age Diseases. *International Journal of Occupational and Environmental Health*. 8(4): 363-370

Thorn, A. (2000) Case Study of a sick building: Could an integrated biopsychosocial perspective prevent chronicity? *European Journal of Public Health*. 10(2): 133-137

U.S. Environmental Protection Agency (1991) Indoor Air Facts No.4 (revised): Sick Building Syndrome (SBS) Available online: <http://www.epa.gov/iaq/pubs/sbs.html>

U.S. Environmental Protection Agency (1990) Fact Sheet: Ventilation and Air Quality in Offices. Available online: <http://www.epa.gov/iaq/pubs/ventilat.html>

U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (2004). 2003-04 U.S. Influenza Season Summary. Available online: <http://www.cdc.gov/flu/weekly/weeklyarchives2003-2004/03-04summary.htm>

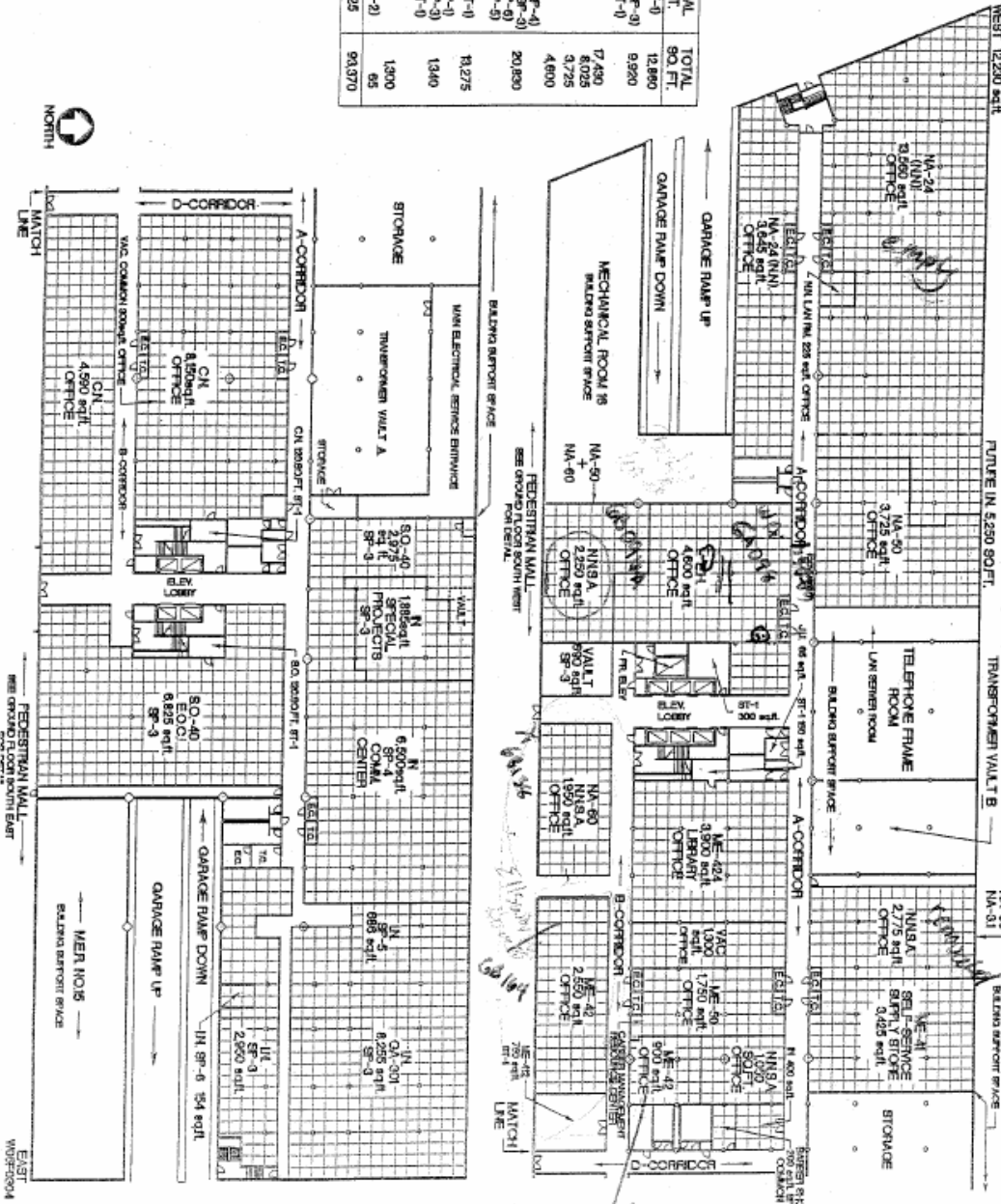
# APPENDIX A



## THE JAMES FORRESTAL BUILDING GROUND FLOOR NORTH (BY FLOOR / ORGANIZATION)

FOR F.Y. 2005  
AS OF 10/01/04  
REVISED 03/23/04

ORGANIZATION	OFFICE SQ. FT.	SPECIAL SQ. FT.	TOTAL SQ. FT.
CNL	12,740	120 (SP-1)	12,860
S.O.-40	9,800 (SP-3)	120 (SP-1)	9,920
NA-24	17,430	0	17,430
NA-60	8,025	0	8,025
EIT	4,800	0	4,800
ME	12,525	0	12,525
COMMON USE	200 (SP-1)	0	200
COPY CTR.	690 (SP-3)	0	690
VACANT	450 (SP-1)	0	450
WORK USE	65 (SP-2)	0	65
FLOOR TOTALS	60,745	32,625	93,370





13. Have you ever noticed dampness or wet areas in your current workplace? Yes \_\_\_ (Go to 13.1) No \_\_\_ (Go to 14)
- 13.1 Is the dampness present currently? Yes \_\_\_ (Go to 13.2) No \_\_\_ (Go to 13.2)
- 13.2 When did you first notice the dampness? \_\_\_ / \_\_\_ (month / year)
14. Have you ever noticed an unusual odor in your current workplace? Yes \_\_\_ (Go to 14.1) No \_\_\_ (Go to 15)
- 14.1 Is the odor present currently? Yes \_\_\_ (Go to 14.2) No \_\_\_ (Go to 14.2)
- 14.2 When did you first notice the odor? \_\_\_ / \_\_\_ (month / year)
- 14.3 Please describe what the odor is like. \_\_\_\_\_
15. Have you ever noticed poor ventilation in your current workplace (i.e., inadequate air flow)? Yes \_\_\_ (Go to 15.1) No \_\_\_ (Go to 16)
- 15.1 Is the poor ventilation present currently? Yes \_\_\_ (Go to 15.2) No \_\_\_ (Go to 15.2)
- 15.2 When did you first notice poor ventilation? \_\_\_ / \_\_\_ (month / year)
16. Have you ever noticed drafty conditions in your current workplace (i.e., uneven or excessive air flow)? Yes \_\_\_ (Go to 16.1) No \_\_\_ (Go to 17)
- 16.1 Are the drafty conditions present currently? Yes \_\_\_ (Go to 16.2) No \_\_\_ (Go to 16.2)
- 16.2 When did you first notice the drafty conditions? \_\_\_ / \_\_\_ (month / year)

17. Have you ever noticed poor temperature control in your current workplace (i.e., too hot or cold)?  
 Yes \_\_\_ (Go to 17.1)  
 No \_\_\_ (Go to 18)

17.1 Is the poor temperature control present currently? Yes \_\_\_ (Go to 17.2)  
 No \_\_\_ (Go to 17.2)

17.2 When did you first notice poor temperature control?  
 \_\_\_ / \_\_\_  
 (month / year)

**MEDICAL HISTORY**

18. Have you experienced any of the following symptoms **between November 1, 2003 and the present** (please check all that apply):

	SYMPTOM	How frequently does this symptom occur <u>at work</u> ?			If you answered "Often" does the symptom get better when you leave work? (circle yes or no)
		Never	Rarely	Often	
18a	persistent cough lasting throughout the day				Yes No
18b	shortness of breath or rapid breathing even without exercising				Yes No
18c	runny nose				Yes No
18d	irritated, burning nasal passages				Yes No
18e	nasal congestion				Yes No
18f	fever above 100 degrees lasting over 2 days				Yes No
18g	coarse, rattling sound in your lungs				Yes No
18h	frequent or persistent headaches				Yes No
18i	persistent watery, burning, irritated, or dry eyes				Yes No



		How frequently does this symptom occur <u>at work</u> ?			
	SYMPTOM	Never	Rarely	Often	If you answered "Often" does the symptom get better when you leave work? ( <i>circle yes or no</i> )
18j	persistent or chronic sore throat				Yes No
18l	swelling of the eyelids and tissues around the eyes				Yes No
18m	wheezing (a whistling sound while breathing)				Yes No
18n	rash, hives, or skin irritation				Yes No
18o	sneezing				Yes No
18p	chest tightness				Yes No
18q	hoarseness, dry throat				Yes No
18r	problems wearing contact lenses (if you wear them)				Yes No
18s	nausea				Yes No
18t	chills				Yes No
18u	aching muscles, body aches				Yes No
18v	dizziness or light headedness				Yes No
18w	tension, nervousness				Yes No
18x	Other symptoms? (please specify) _____ _____ _____				Yes No

18.1. When did your symptoms begin? \_\_\_\_ / \_\_\_\_ / \_\_\_\_  
(mm/dd/yy)

18.2 Did your physician diagnose the cause of these symptoms?  
Yes \_\_\_\_ (go to 18.3)  
No \_\_\_\_ (go to 18.4)

18.3 What was the diagnosis? \_\_\_\_\_ (go to 18.4)

18.4 Do you feel that the symptoms you've  
experienced are related to your work location? Yes \_\_\_\_ (go to 19)  
No \_\_\_\_ (go to 19)

19. Has a doctor *ever* diagnosed you with any of the following conditions?  
(Check as many as apply)

<u>DIAGNOSIS</u>	<u>IF YES:</u>	<u>STILL HAVE CONDITION?</u>
19.1 Chronic bronchitis ____	Year first diagnosed? ____	Yes __ No__
19.2 Asthma ____	Year first diagnosed? ____	Yes __ No__
19.3 Emphysema ____	Year first diagnosed? ____	Yes __ No__
19.4 Chronic pharyngitis ____	Year first diagnosed? ____	Yes __ No__
19.5 Chronic sinusitis ____	Year first diagnosed? ____	Yes __ No__
19.6 Hayfever ____	Year first diagnosed? ____	Yes __ No__
19.7 Pulmonary fibrosis ____	Year first diagnosed? ____	Yes __ No__
19.8 Pleurisy ____	Year first diagnosed? ____	Yes __ No__
19.9 Tuberculosis ____	Year first diagnosed? ____	Yes __ No__
19.10 Pneumonia ____	Year first diagnosed? ____	Yes __ No__
19.11 Chronic cough ____	Year first diagnosed? ____	Yes __ No__
19.12 Recurrent or chronic sore throat ____	Year first diagnosed? ____	Yes __ No__

- 19.13 Abscess of lung \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.14 Irritation or  
burning in your  
nasal passages \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.15 Severe or  
frequent headaches \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.16 Rash, hives, or  
skin irritation \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.17 Watery, burning,  
or irritated eyes \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.18 Dizziness \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.19 Lack of or poor  
coordination \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_
- 19.20 Sensation of numbness  
or prickling in your  
fingers or toes \_\_\_\_\_ Year first diagnosed? \_\_\_\_\_ Yes \_\_\_ No\_\_

20. Have you ever been diagnosed with allergies? Yes \_\_\_\_\_ (*go to 20.1*)  
No \_\_\_\_\_ (*go to 21*)

20.1 When were you first diagnosed with allergies? \_\_\_\_\_ / \_\_\_\_\_  
Month Year

20.2 To what are you allergic? \_\_\_\_\_  
\_\_\_\_\_

21. Do you ever experience wheezing (e.g, breathing with difficulty, accompanied by a whistling sound)

- 21.1 When you have a cold? Yes \_\_\_\_\_ No \_\_\_\_\_
- 21.2 Occasionally apart from colds? Yes \_\_\_\_\_ No \_\_\_\_\_
- 21.3 Most days or nights? Yes \_\_\_\_\_ No \_\_\_\_\_

NONOCCUPATIONAL EXPOSURES

22. Have you recently used pesticides at home? Yes \_\_\_\_\_ (go to 22.1)  
No \_\_\_\_\_ (go to 23)

22.1 When did you use them most recently? \_\_\_\_\_ / \_\_\_\_\_  
Month Year

23. Have you recently used an exterminator at home? Yes \_\_\_\_\_ (go to 23.1)  
No \_\_\_\_\_ (go to 24)

23.1 When was the exterminator used most recently? \_\_\_\_\_ / \_\_\_\_\_  
Month Year

24. Have you recently used a chemical lawn service at home? Yes \_\_\_\_\_ (go to 24.1)  
No \_\_\_\_\_ (go to 25)

24.1 When was this service used most recently? \_\_\_\_\_ / \_\_\_\_\_  
Month Year

24.2 Please describe the chemicals and their purpose:

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TOBACCO USE:

25. Have you smoked at least 100 cigarettes during your entire life?  
(1 pack = 20 cigarettes)

Yes \_\_\_\_\_ (Go to 25.1)  
No \_\_\_\_\_ (Go to 26)

25.1 Do you smoke cigarettes now?

Yes \_\_\_\_\_ (Go to question 25.1.1)  
No \_\_\_\_\_ (Go to question 25.2)

25.1.1. On average, how many cigarettes per day do you now  
smoke?

\_\_\_\_\_ cigarettes

25.2 How long has it been since you smoked  
cigarettes fairly regularly?

\_\_\_\_\_ (number of ) years (*Go to 25.4*)

\_\_\_\_\_ under 1 year (*go to 25.3*)

\_\_\_\_\_ Never smoked cigarettes regularly (*Go to 26*)

25.3 On average, how many cigarettes a day were you  
smoking 12 months ago?

\_\_\_\_\_ cigarettes per day (*go to 25.4*)

\_\_\_\_\_ did not smoke (*go to 26*)

25.4 During the period when you were smoking the **most**,  
how many cigarettes did you smoke per day?

\_\_\_\_\_ cigarettes per day (*go to 25.5*)

\_\_\_\_\_ did not smoke (*go to 26*)

25.5 How old were you when you first started smoking cigarettes  
fairly regularly?

\_\_\_\_\_ years old (*go to 26*)

\_\_\_\_\_ never smoked cigarettes fairly regularly (*go to 26*)

26. Does anyone else smoke in your home?

Yes \_\_\_\_\_

No \_\_\_\_\_

27. Have you ever used any of the following tobacco products?

27.1 Cigars:

Yes \_\_\_\_\_ (*Go to 27.1.1*)

No \_\_\_\_\_ (*Go to 27.2*)

27.1.1 During the period when you smoked cigars the most, about how many cigars did you smoke per day?

\_\_\_\_\_ \_\_\_\_\_ cigars per day

27.2 Pipe:

Yes \_\_\_\_\_ (*Go to 27.2.1*)

No \_\_\_\_\_

27.2.1 During the period when you smoked a pipe the most, about how many bowls of tobacco did you smoke per day?

\_\_\_\_\_ \_\_\_\_\_ bowls per day

THIS CONCLUDES THE SURVEY.

Thank you for taking the time to respond to these questions. If you have any further comments or information you would like to share with us, please feel free to write your comments below.

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## APPENDIX C

May 4, 2004

Dear DOE Employee:

Several Department of Energy Headquarters workers have expressed concern that working conditions in the Forrestal Building may have affected their health. The Office of Occupational Health has been asked to investigate these concerns and is inviting you to participate in this workplace survey.

The enclosed questionnaire requests information on your work location, symptoms or illnesses you might have had, and some lifestyle choices. The questionnaire takes less than 15 minutes to complete. Your name or other identifying information is not required. It is very important to us that you participate, even if you have had no symptoms or health concerns. The answers you provide will help us determine the extent and nature of any workplace factors potentially affecting workers' health. I encourage you to assist us by answering the questions, but whether or not you participate in this assessment will have no effect on your employment status. If there is a particular question you prefer not to answer, simply skip that question and move on to the next one.

The information you provide will be held in strict confidence. It will be used only to help us determine whether workplace conditions might be affecting the health of workers. Any reports from this investigation will not mention any names, nor will any identification be stored with the questionnaire you return to us.

We would appreciate your completing the questionnaire and returning it to:

Dr. Cliff Strader  
Mail Stop EH53/270CC  
GTN

no later than May 14, 2004. If you have any questions about the assessment, please feel free to contact Dr. Strader at 301-903-5799 or by e-mail at [cliff.strader@eh.doe.gov](mailto:cliff.strader@eh.doe.gov).

Thank you for your attention.

Sincerely,

Bonnie Richter, Director  
Office of Occupational Health

## **APPENDIX D**

### **INDUSTRIAL HYGIENE REVIEW**

**October 2005**

Industrial hygiene assessments of the workspaces of concern were not provided to us until September 12, 2005, after our analysis had been completed and report issued. The analyses, conducted by M.A. Cecil and Associates, Inc, reflected repeated industrial hygiene testing conducted over the period July 1999 to March 2004. We agreed to review these assessments and note any modifications of our original conclusions, should the results of these analyses indicate the need.

Bioaerosol and dust mite testing of Room GA007 conducted on July 26, 1999, found no source for the occupant's health complaints of skin irritation and sinus congestion. The report noted that cleaning of the area by custodial staff appeared adequate and recommended the continuation of the current cleaning frequency.

Testing was conducted November 13, 2002, in suite GP196. An employee had complained of allergy-like symptoms. All measurements were within consensus standards, i.e., within acceptable limits. Air samples had low fungi and bacterial concentrations typical for an office environment and lower than outdoor concentrations. Air exchange was well above the recommended 20 cubic feet per minute per occupant. No causal agent for the employee's symptoms was identified.

Further testing was conducted on room GP196 on June 17, 2003, in response to an employee's concern about allergy-like symptoms. No specific causal agent was found. Gram-negative bacterial concentrations were minimally elevated compared with the outdoor air levels. Otherwise, all bioaerosol and thermal measurements were within consensus standards. The analyst recommended that the ventilation system be inspected to ensure that condensate pans were draining properly. Stagnant water in the pans were cited as a possible source of the bacteria. The room is located below grade, so moisture from the adjacent concrete deck could also establish conditions favorable for microbial proliferation in the carpet. He recommended carpet cleaning on a regular basis.

Subsequent sampling and testing conducted on March 18, 2004, in the GB138 area was carried out in response to concerns about the potential impact of a chronic water leak in the wall of the office on air quality. Testing included bioaerosol sampling, spore determinations, relative humidity, temperature, carbon dioxide, and carbon monoxide determinations. All measurements were within normal limits. Housekeeping appeared adequate, with the exception of episodic wetting of the rug in the southwest corner of the room due to the water leak.

On March 18, 2004, air quality evaluation was also conducted in GP196. Concern was raised due to a chronic water leak in the wall of the office. Results were all within consensus standards. Again, no agent likely to be associated with employee's symptoms was identified. The analyst



recommended that affected employees keep a log of symptom occurrence that also tracked outside weather conditions and any other environmental factors that might be of concern.

Our overall conclusion is that the available industrial hygiene data incorporating analyses over a period of more than four years failed to identify specific causes for a variety of nonspecific employee complaints of allergy-like symptoms, skin irritation, and nasal congestion. A variety of measurements taken during each sampling event indicated that the workspace air quality and general cleanliness have been well maintained and are not likely to be causal in the health concerns of interest.

Overall, air quality and thermal regulation remained well within consensus standards. The one exception cited was a finding of gram-negative bacterial concentrations slightly above outdoor levels found during a June 2003 survey of room GP196. The analyst cited inadequate drainage of the stagnant water in the ventilation system's condensation pans as a possible source for the bacteria. A reassessment of GP196 air quality conducted in March 2004 did not find bacterial concentrations above the consensus standards. Recommendations included prompt attention to recurrent wetting of the carpet by a water leak within a wall and the overall need for continued, frequent vacuuming of carpets. The analysts were unable to conduct very specific tests for individual, potentially causal agents without knowledge of specific causal agents identified by the employees' physicians. However, the available findings do not support a link between environmental factors in the workplace and a variety of symptoms as reported in our survey.