

**HETA 91-0040-2510  
JUNE 1995  
KRAFT GENERAL FOODS, INC.  
MAXWELL HOUSE COFFEE, CO.  
HOUSTON, TEXAS**

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## **I. SUMMARY**

In November 1990, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the United Food and Commercial Workers International Union, AFL-CIO, Local Union 408, to evaluate worker exposures to coffee dust, methylene chloride, asbestos dust, phosphine, and vitamin dust, and to investigate a possible increased occurrence of cancer among workers at the Kraft General Foods, Inc., Maxwell House Coffee Company in Houston, Texas.

On January 23, 1991, a walk-through survey of the instant coffee and rice production areas was conducted to observe the industrial processes used in these areas. On March 26 and 27, 1991, industrial hygiene sampling for respirable dust and phosphine was conducted in the two production areas. Work practices were observed in the coffee roasting areas, coffee grinding areas, and the vitamin addition room of the rice processing area. The removal of phosphine from railroad cars was reviewed as well. None of the personal breathing zone (PBZ) or area air concentrations of respirable dust collected in the coffee and rice production areas exceeded the current occupational exposure limits for particles not otherwise classified (nuisance dust). The results from the phosphine sampling are not interpretable due to the presence of phosphine on the back-up sections of the tubes and the field blanks. Parallel sampling conducted by the company showed barely detectable concentrations of phosphine. There were no longer any source of exposure to asbestos dust or methylene chloride at the time of the site visits.

The medical department daily logs for 1990 and January 1991 and a respiratory questionnaire that the company administered prior to employment for evaluation of fitness to wear respirators were reviewed. From the medical department daily logs, 27 (4.9%) of approximately 550 workers reported with respiratory symptoms suggestive of asthma. The company had reported two bronchial asthma deaths in the early 1980s. A proportionate mortality ratio (PMR) study was used to investigate cancer mortality patterns among employees who died from January 1980 to March 1992. Copies of death certificates for 67 of the 79 eligible workers were obtained. The PMR study showed a statistically significant excess of all malignant neoplasms for white males but not for the other three race/sex groups. The predominant malignant neoplasm reported was lung cancer; the PMR for this site was not significantly elevated for any of the race/sex groups. Based on the lack of historical exposure data, it is not possible to link a specific causal agent to the excess cancer deaths for white males in the time period

studied. The company did have asbestos in the facility (it was all removed by 1991) and used methylene chloride in the past (prior to 1988), but there are not enough exposure data nor length of employment data available to connect these potential exposures with the cancer deaths.

Data from the medical department daily logs suggest that individuals have reported symptoms consistent with asthma, but it was not possible to determine if there was an excess of asthma or other respiratory problems. Although none of the PBZ or area air concentrations of respirable dust collected in the coffee and rice production areas exceeded the current occupational exposure limits for nuisance dust, these criteria are not appropriate for biologically active substances and will not protect against allergic responses. It was not possible to determine a causal factor for the apparent excess of all malignant cancer deaths for white males as determined by the PMR analysis. Recommendations to improve the work environment are offered in Section VIII of this report.

**KEYWORDS:** SIC 2095 (Roasted Coffee), coffee dust, occupational asthma, phosphine, respirable dust, methylene chloride, proportional mortality ratio, PMR.

## II. INTRODUCTION

In November 1990, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the United Food and Commercial Workers International Union, AFL-CIO, Local Union 408, to evaluate worker exposures to coffee dust, methylene chloride, asbestos dust, phosphine, and vitamin dust, and to investigate a possible increased occurrence of cancer among workers at the Kraft General Foods, Inc., Maxwell House Coffee Company in Houston, Texas. On January 23, 1991, NIOSH representatives conducted an initial site visit to the facility. A follow-up industrial hygiene survey was conducted on March 26 and 27, 1991. A letter reporting the industrial hygiene -sampling results and preliminary recommendations was issued in April 1992.

## III. BACKGROUND

The Maxwell House Coffee Company produces instant coffee and processed rice. At the time of the site visits, the facility employed approximately 550 workers, including office staff, over three shifts, seven days a week. According to company officials, the activities were approximately the same on each shift. At the time of the walk-through, contractors had removed the asbestos, mostly used as roofing fill and insulation for the cooling towers, from the plant with the exception of one cooling tower. It had taken four to five years to complete the asbestos removal process.

### Coffee Processing

At the time of the surveys, green coffee beans were brought to the facility in bulk and moved by conveyor into the green coffee silos. A contractor was responsible for loading the large trucks with coffee beans and transporting the beans to the facility. The green coffee bean silos underwent routine maintenance three to four times a year. The green coffee silos were cleaned out once a year when the entire coffee making process was shut down. The chaff from the green coffee beans silos was collected into bins for disposal. Employees were offered dust masks to wear if they wished when working with green coffee chaff. Green coffee beans were automatically transferred from the storage silos to weighing scales, and then to the coffee roasters. During the second site visit, two out of eight roasters were operating. The isothermal roasters were used in a continuous process. After roasting, the coffee beans went to a stirring machine. According to management representatives and employees, smoke could be a problem in this area whenever a newly roasted load was dumped or a malfunction occurred. The employees in the stirring area generally worked in a climate controlled area. Grinding was a five-day-per-week operation. According to company representatives, bag houses were used to collect dust from the coffee roasters and presented a fire hazard. The bins from the bag houses for the coffee roasters were changed as needed by various employees.

Methylene chloride was used as a decaffeinating agent for coffee from mid-1975 until 1987. At the time of the site visit, the company used a chemical carbon dioxide (CO<sub>2</sub>) method. The decaffeinating process using CO<sub>2</sub> was totally automated. With the exception of maintenance staff, employees worked in a control center. In case of an unintended CO<sub>2</sub> release, a series of safety controls were in place, including sign-in procedures, radio communications, leak alarms, and evacuation plans. The decaffeinating facility began operations in the early 1950s. Prior to mid-1975, the solvent that had been used in decaffeination (for more than 20 years) was trichloroethylene.

#### Rice Processing

Rice was brought to the facility in railroad cars which remained in the unloading area until the tablets of phosphine, a restricted-use pesticide specifically used to control insect infestations, were removed manually. The company had a written policy for confined space entry to remove phosphine from the railroad cars. The policy required the use of self-contained breathing apparatus (SCBA) by employees. The policy included opening of the railroad car 15-20 minutes before entry. The removal process was established with assistance from the Occupational Safety and Health Administration (OSHA) Dallas, Texas office. According to the OSHA inspector who conducted a survey in 1987, no citation for overexposure to phosphine had been issued.

After unloading, the rice was cooked and dehydrated. During the final process, a vitamin mix of thiamine, niacin, and iron in a starch carrier was added. Climate controlled areas were provided for operators in the rice processing areas. The majority of work in the rice area was done from these control areas.

## **IV. METHODS**

### **A. Industrial Hygiene Evaluation**

On January 23, 1991, a walk-through survey of the instant coffee and rice production areas was conducted to observe the industrial processes used. Four bulk dust samples (three from the coffee processing areas and one of vitamins) were collected and analyzed for the presence of respirable particles with a size of 10 micrometers (µm) in diameter or less using polarized light microscopy.

On March 26 and 27, 1991, industrial hygiene sampling was conducted in the two production areas. Eight personal breathing zone (PBZ) and two area air samples were collected for respirable particulates not otherwise classified (PNOC) in the coffee processing areas; two PBZ and two area air samples were collected for respirable PNOC in the rice processing area. The samples were collected with 37-mm diameter, 5.0 µm pore size polyvinyl chloride (PVC) filters in conjunction

with a 10-mm cyclone at a sampling flowrate of 1.7 liters per minute (l/min). Samples were collected for a period as near as possible to an entire workshift. The sample weights were determined according to NIOSH Method 600.<sup>1</sup> The analytical limit of detection (LOD) was 0.01 milligrams (mg), which is equivalent to a minimum detectable concentration (MDC) of 0.017 mg/m<sup>3</sup>, assuming a sample volume of 602 liters.

Four area phosphine samples were collected on silica gel tubes coated with mercuric cyanide, in 300 mg/150 mg sections, at a flow-rate of 0.2 l/min.

The tubes were analyzed by visible spectroscopy according to NIOSH Method S-332.<sup>2</sup> The limit of quantitation (LOQ) was 3.9 micrograms (µg) per sample. The analytical LOD and limit of quantitation (LOQ) were 1µg and 3.9µg per sample, respectively. The MDC and minimum quantifiable concentration (MQC) for phosphine, assuming an average sample volume of 71 liters, were 0.01 mg/m<sup>3</sup> and 0.06 mg/m<sup>3</sup>, respectively.

Work practices were observed in the coffee roasting areas, coffee grinding areas, and the vitamin addition room of the rice processing area. The railroad car phosphine removal procedure was reviewed.

#### **B. Medical Evaluation**

The medical evaluation sought to address employee health concerns related to coffee dust exposure and a perceived excess in cancer mortality among production and maintenance workers. During the initial visit, NIOSH representatives conducted informal discussions with production employees and management, and reviewed the OSHA Form 200 (Log and Summary of Occupational Injuries and Illnesses) for 1990 and January 1991. A copy of the 1990 Medical Department Daily Log was requested and later reviewed for indications of possible sensitization to coffee dust.

To address the perceived cancer cluster, NIOSH representatives first planned to compare the rate of cancer deaths in the Maxwell House workforce (both presently employed and retired workers) over a period of time to the rate of cancer deaths in the general working population of similar age and sex distribution. However, Maxwell House Division corporate headquarters was not able to supply NIOSH with the necessary work history information to identify all members of the cohort. Therefore, NIOSH representatives chose to perform a less definitive analysis, which compares the proportion of deaths due to cancer in the Maxwell House workforce (both presently employed and retired workers) over a period of time to the proportion of deaths due to cancer in the general U.S. population of workers greater than age 15 and with a similar sex distribution.

Mortality patterns were investigated using a proportionate mortality ratio (PMR)

study. PMR studies look at the proportion of deaths attributable to a specific cause or group of causes. A PMR of 100 results when the observed number of deaths equals the number expected based on the reference population. A PMR greater than 100 means that there were more observed than expected deaths, and a PMR less than 100 means that there were fewer observed than expected deaths.

Both the union and the medical department at Maxwell House Coffee provided lists of current and former employees who were known to have died from January 1980 to March 1992. According to the information supplied by the company and the union, 79 current and former employees were known to have died during that time period. We obtained copies of death certificates for 67 of the 79 deceased workers. Death certificates for 12 individuals (three individuals who died while employed at Maxwell House, seven employees who had been terminated, and two individuals with autopsy reports) were not on file with the State of Texas Bureau Vital Statistics or available from either union or company files. The underlying causes of death were coded from the death certificates by a qualified nosologist using the International Classification of Diseases (ICD), 9th edition, which was in effect during the entire study period.

PMRs were determined using a NIOSH computer program which used the proportions of cause-specific deaths for several million U.S. workers throughout the country. All races were included in the analysis. Since the calculated PMR is subject to sampling error, the precision of the estimate is expressed as a confidence interval (CI) around the PMR. An elevated (or decreased) PMR is considered to be statistically significant if there is less than a 5% probability that it is the result of chance alone, that is, if the 95% CI does not include the PMR value of 100.

## **V. EVALUATION CRITERIA AND TOXICOLOGY**

To assess the hazards posed by workplace exposures, industrial hygienists use a variety of environmental evaluation criteria. These criteria propose exposure levels to which most employees may be exposed for a normal working lifetime without adverse health effects. These levels do not take into consideration individual susceptibility, such as pre-existing medical conditions, or possible interactions with other agents or environmental conditions. Evaluation criteria for chemical substances are usually based on the average personal breathing zone exposure to the airborne substance over an entire 8- to 10-hour workday, expressed as a time-weighted average (TWA).

The primary sources of evaluation criteria for the workplace are: NIOSH Criteria Documents and Recommended Exposure Limits (RELs),<sup>3</sup> the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs),<sup>4</sup> and OSHA Permissible Exposure Limits (PELs).<sup>5</sup> Evaluation criteria change over time

with the availability of new toxicologic data.

The OSHA PELs reflect the economic feasibility of controlling exposures in various industries, public notice and comment, and judicial review; whereas the NIOSH RELs are based primarily on concerns related to the prevention of occupational disease. An additional complication is the Court of Appeals decision that vacated the OSHA 1989 Air Contaminants Standard (*AFL-CIO vs. OSHA*, 965F.2d 962 [11th cir., 1992]); OSHA is now enforcing the previous 1971 standards.<sup>5</sup> However, some states which have OSHA-approved State Plans will continue to enforce the more protective 1989 limits. NIOSH encourages employers to use the 1989 limits or the RELs, whichever are lower.

### Phosphine

Phosphine is manufactured as a compressed tablet which is transformed into a gas upon exposure to moisture. This substance is classified by the U.S. Environmental Protection Agency (EPA) as a restricted-use pesticide. Phosphine is a severe pulmonary irritant. Short-term over-exposure may cause coughing, shortness of breath, and severe breathing difficulty. It can also cause thirst, nausea, vomiting, stomach pain, diarrhea, back pain, a feeling of coldness, and fainting.<sup>6</sup> It has a characteristic fishy-garlic odor. The effects of chronic, low-level exposure to phosphine are not well defined. These effects have been reported to include anemia, bronchitis, gastrointestinal disturbances, and nervous system disorders, including visual, speech, and motor disturbances.<sup>7</sup> NIOSH, ACGIH, and OSHA have established exposure limits of 0.4 mg/m<sup>3</sup> as a TWA and 1 mg/m<sup>3</sup> as a 15-minute short term exposure limit (STEL).<sup>3,4,5</sup>

### Asbestos

NIOSH considers asbestos (i.e., actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite) to be a potential occupational carcinogen and recommends that exposures be reduced to the lowest possible concentration. It is also well-documented that there is a multiplicative effect of asbestos and cigarette smoking on lung cancer risk. Asbestos workers who smoke cigarettes had a 60-fold increased risk of lung cancer when compared with employees who were not exposed to asbestos and did not smoke.<sup>8</sup>

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For asbestos fibers >5 micrometers in length, NIOSH has established a REL of 100,000 fibers per cubic meter of air (100,000 fibers/m<sup>3</sup>), which is equal to 0.1 fiber per cubic centimeter of air (0.1 fiber/cm<sup>3</sup>), as determined by a 400-liter air sample collected over 100 minutes and NIOSH analytical Method 7400.<sup>9</sup>

As found in 29 CFR 1910.1001 and 1926.1101, the OSHA TWA exposure limit for asbestos fibers is an 8-hour time-weighted average airborne concentration of 0.1 fiber (longer than 5 micrometers and having a length-to-diameter ratio of at least 3 to 1) per cubic centimeter of air (0.1 fiber/cm<sup>3</sup>), as determined by the membrane filter method at approximately 400X magnification with phase contrast illumination.<sup>10</sup> OSHA has also imposed an excursion limit which requires that no worker be exposed in excess of 1 fiber/cm<sup>3</sup> as averaged over a sampling period of 30 minutes.

### Methylene Chloride

Methylene chloride has been used as a paint remover, degreasing agent, aerosol propellant, a process solvent in the manufacture of pharmaceutical and food products, and a fumigant for grain and fruits. Methylene chloride is a mild central nervous system depressant and an eye, skin, and respiratory tract irritant; it is carcinogenic in laboratory animals.<sup>11</sup> Mice exposed to methylene chloride in air developed alveolar/bronchial cancer and cancer of the liver. Rats exposed to methylene chloride in air developed tumors of the mammary gland and cancer of the salivary glands. One epidemiologic study of a small worker population found a non-statistically significant excess of pancreatic cancers.<sup>12,13</sup> Other epidemiologic studies were inconclusive.<sup>11,14</sup> There is some evidence to suggest that employees exposed to methylene chloride may be at increased risk of developing ischemic heart disease.<sup>14</sup>

NIOSH has classified methylene chloride as a suspected human carcinogen and has recommended that occupational exposure be reduced to the lowest feasible concentration.<sup>3</sup> ACGIH has classified methylene chloride as a suspected human carcinogen and set, as a TLV, an 8-hour TWA of 50 ppm.<sup>4</sup> In 1991, OSHA proposed a new standard for methylene chloride. The proposed standard would establish an 8-hour TWA of 25 ppm and a STEL of 125 ppm.<sup>15</sup> The current OSHA PEL is an 8-hour TWA of 500 ppm, a ceiling of 100 ppm and a maximum peak exposure of 6000 ppm (5 minute exposure in a 2 hour period).<sup>5</sup>

### Rice-Vitamin Dust

Little published information is available concerning occupational exposure to rice and vitamin dust. Olenchok and associates conducted a study at a rice production commune to determine respiratory exposures to airborne dusts and endotoxins.<sup>16,17</sup> Bacterial endotoxin, a lipopolysaccharide compound from the outer cell wall of gram-negative bacteria, occurs abundantly in organic dusts.<sup>18</sup> The biological properties of

endotoxins vary depending upon the bacterial species from which they are derived, as well as upon the state of the growth cycle of the bacteria.<sup>19</sup> Endotoxins have a wide range of biological effects involving inflammatory, hemodynamic, and immunological responses. Of most importance to occupational exposures are the effects of endotoxin in the lung.<sup>20</sup> A study in China showed that rice production is associated with endotoxin exposure specifically in the hulling area.<sup>16,17</sup> A literature search yielded no information pertaining to the potential health effects associated with occupational exposures to niacin, thiamin, or iron supplements in organic dusts.

### Occupational Asthma

Asthma is a common disease, affecting between 10 and 20 million people in the United States, or about 5 to 10% of the population.<sup>21,22</sup> The common symptoms of asthma include wheezing, shortness of breath, chest tightness, and coughing, which are caused by a temporary obstruction of the airways of the lungs. An estimated 2% of all asthma cases in the U.S. are believed to be caused or aggravated by workplace exposures such as dusts, fumes, gases, and vapors.<sup>21,23</sup> Over 200 agents in U.S. work places have been found to cause occupational asthma. Common mechanisms of occupational asthma include:<sup>24</sup>

1. Direct airway irritation (reflex bronchoconstriction)

In this type of occupational asthma, the airways of the lung are irritated by many nonspecific agents such as cold air, dust particles, gases, and fumes. This type does not involve the body's immune system, and in most cases, the individual has a history of asthma prior to any occupational exposure. People with this type of asthma are considered to have excessively reactive (hyperactive) airways, and they generally develop symptoms of shortness of breath, chest tightness, cough, and wheezing immediately after exposure to occupational or other agents. Symptoms can occur following exposure to very low concentrations of an irritant. Common substances that can produce irritant-mediated occupational asthma include alcohols, ammonia, formaldehyde, and cigarette smoke.

2. Inflammatory bronchoconstriction

This type of asthma results from inhalation of irritant gases and vapors in very high concentrations. The irritant gases cause damage to the cells lining the bronchial airways and result in an "inflamed" airway. The individual has symptoms of shortness of breath, wheezing, chest tightness, and cough. Symptoms usually resolve within several weeks, but in some individuals the symptoms can persist following exposure (over extended periods) to low levels of many non-specific irritants.

3. Allergic bronchoconstriction (Type I hypersensitivity)

This is the most common type of occupational asthma. Susceptible workers develop antibodies after being exposed to substances at work, and repeated exposure causes asthma to develop. The time between first exposure to a substance and development of an asthmatic reaction test can vary from weeks to years. Once asthma has developed, symptoms may occur immediately after exposure, following a delay of several hours, or in a pattern with both early and late components.

Lung disease associated with coffee processing

Green coffee beans contain an allergen which is responsible for allergic symptoms in from 7 to 40% of coffee roastery workers.<sup>25</sup> A number of studies have documented lower respiratory symptoms and asthma in coffee workers who were exposed to coffee bean dust.<sup>26-28</sup> Using pulmonary function testing, Zuskin found that coffee workers who were exposed to green or roasted coffee had reduced lung function (obstructive changes) compared to workers who were not exposed.<sup>26</sup>

More recent studies have sought to understand the immunological response to exposure to coffee dust that can lead to occupational asthma.<sup>29-32</sup> In a 1982 study of 372 coffee processing plant workers exposed to relatively low concentrations of total, green, mixed, and roasted coffee dust (0.48 mg/m<sup>3</sup> or less), the prevalence of lower respiratory symptoms suggestive of asthma was about equal among exposed and unexposed workers. However, workers with more than five years employment and exposure to green coffee dust, and those with antibodies in their blood to green coffee dust had decreased baseline lung function compared to other workers. The study showed that a decline in lung function can occur in workers with exposures to low levels of coffee dust.<sup>29</sup>

For OSHA compliance purposes, coffee dust is considered a particulate not otherwise regulated. However, at levels below the current OSHA PELs (5 mg/m<sup>3</sup> for respirable dust and 15 mg/m<sup>3</sup> for total dust<sup>5</sup>), exposure to organic dusts can cause acute irritant or allergic upper and lower respiratory symptoms, and system toxicity.<sup>33</sup> The ACGIH TLV® for particulates not otherwise classified (PNOC) is 10 mg/m<sup>3</sup> for an 8-hour TWA for total dust containing no asbestos and <1% crystalline silica.<sup>4</sup> For 1995-1996, ACGIH intends to adopt 8-hour TWA TLVs for PNOC of 10 mg/m<sup>3</sup> for inhalable particulates containing no asbestos and <1% crystalline silica and 3 mg/m<sup>3</sup> for respirable particulates containing no asbestos and <1% crystalline silica.<sup>34</sup> NIOSH does not have any exposure limits for either "nuisance" dust or organic dust, but given that coffee dust may be toxic and allergenic, the PNOC or nuisance dust criteria are inappropriate.

## VI. RESULTS

### A. Industrial Hygiene

The results for the PBZ and area air samples collected in the coffee processing areas for respirable dust are shown in Table 1. The PBZ exposures ranged from 0.03 to 0.17 mg/m<sup>3</sup>. The area air sample concentrations ranged from 0.03 to 0.05 mg/m<sup>3</sup>. None of the sample concentrations exceeded the OSHA PEL of 5 mg/m<sup>3</sup> for respirable dust. The three bulk samples from the green coffee scale and silos, and the bulk vitamin mix sample collected during the first site visit did contain respirable particles less than 10 µm in size.

The results for the PBZ and area air samples for respirable dust collected in the rice processing area are presented in Table 2. The PBZ exposures ranged from 0.01 to 0.07 mg/m<sup>3</sup>. The area air samples concentrations ranged from nondetectable to 0.03 mg/m<sup>3</sup>. None of the samples exceeded the OSHA PEL of 5 mg/m<sup>3</sup> for respirable dust.

The results for the area air samples collected in the rice unloading area for phosphine using the silica gel tubes are questionable due to the fact that more than 30% of the analyte in the first section was found on the backup section on all tubes, including the field blanks. The company conducted direct reading measurements for phosphine at the same time as NIOSH investigators and found trace levels.

During the walk-through survey, it was noticed that the coffee roasting process generated intense heat, and the rice cooking also generated large quantities of heat and steam. The operators in both areas spent major portions of their day in the climate-controlled rooms. The maintenance staff appeared to have the highest potential for heat exposure. The rice processing operator hand-scooped the vitamin mix from the storage container into the sifter which automatically added the mix to the rice. This was done once or twice during the shift.

Methylene chloride was no longer in use at the facility at the time of the current study. A study completed in 1978 under a NIOSH contract, however, evaluated potential past exposures. At the time of the 1978 survey, 53 to 58 salaried and hourly employees worked in the decaffeination area. The survey team sampled every operator working in the decaffeinating department. Breathing zone samples were taken with charcoal tube/sampling pump assemblies for approximately eight hours on all shifts. Area sampling for coffee dust was also conducted. Total and respirable coffee dust samples were collected on preweighed 37-mm diameter, 0.8-µm pore-size PVC filters. The respirable coffee dust samples were collected using a 10 mm cyclone assembly. The range of 8-hour exposure concentrations

varied from 0.3 to 33.2 ppm, with an average concentration of 2.9 ppm. All of the concentrations for methylene chloride were well below the environmental evaluation criteria in effect in 1978 (OSHA PEL: 500 ppm and the ACGIH TLV: 200 ppm). The study found low levels of coffee dust (less than 1 mg/m<sup>3</sup>).<sup>35</sup>

**B. Medical Evaluation**

Review of Medical Department Log

A Maxwell House Coffee employee representative reported knowledge of at least three workers who were believed to have experienced symptoms suggestive of sensitization to green coffee dust; one of the three workers reportedly died of bronchial asthma. Information provided by the medical department revealed that another employee, who had been transported by ambulance from work, also died of bronchial asthma. These two asthma deaths occurred in 1981 and 1982. The 1990 Medical Department Daily Log was reviewed for entries potentially related to asthma. Entries were considered to be potentially related to asthma if any of the following conditions were reported, without mention of underlying illness such as upper respiratory infection: asthma attack, hospitalization for pulmonary symptoms, usage of asthma medication, allergy testing or injections, and symptoms consistent with a diagnosis of current asthma (shortness of breath, chest pain or tightness, cough, or wheeze).<sup>22,36</sup> Each individual was counted only once, regardless of how many times his/her name appeared on the log; the most severe symptom or the most involved treatment was recorded.

Table 3 presents the findings of the log review. Three employees reported asthma attacks; two cases required hospitalization. Two other hospitalizations for unspecified respiratory conditions were recorded; one worker received a bronchodilator treatment while hospitalized. Two workers (other than those already discussed) reported the use of bronchodilator medications, which are commonly used to relieve symptoms of asthma. Four individuals who had not reported asthma attacks were undergoing allergy testing and/or injections. Sixteen additional workers reported to the medical department with chest pain, lung congestion, wheezing, or cough without mention of acute upper respiratory illness. A separate review of the 1990 OSHA 200 Log revealed no entries for work-related respiratory conditions.

### Proportionate Mortality Ratio (PMR) Analysis

Of the 67 deaths available for analysis, 28 had an underlying cause of death coded as a malignant neoplasm. The results of the PMR analysis for all malignant neoplasms are presented in Table 4. The number of deaths from all malignant neoplasms was significantly higher than expected for white males (PMR=193; 95%CI: 105 to 324). The number of deaths for the other race and sex groups (black males: PMR=113; 95%CI: 56 to 201; white females: PMR=120; 95%CI: 25 to 352) were elevated but not statistically significantly different than expected. The total number of deaths from all malignant neoplasms was also not significantly different than expected (PMR=138; 95%CI: 92 to 200).

Site-specific cancer data are shown in Table 5. The lung was the predominant cancer site for the three sub-groups in which deaths occurred (white males, black males, and white females), accounting for nine of the 28 cancer deaths (32%) in the study group. Prostate and colon were the next most common sites, accounting for three deaths each in the study population. The results of the PMR analysis for lung cancer are shown in Table 6; the number of deaths was not significantly different than expected.

## **VII. DISCUSSION AND CONCLUSIONS**

Review of Medical Department Daily Logs provided a 'snapshot' of employee visits to the medical department for respiratory symptoms during 1990. Twenty-seven (4.9%) of approximately 550 workers reported with respiratory conditions and allergies that might be related to asthma; this percentage of workers is comparable to the estimated percentage of 5 to 10% of people in the United States with asthma.<sup>22,37</sup> However, it is unknown how many of the employees who were classified as having log entries "potentially related to asthma" have been exposed to coffee dust or have become sensitized to it. It is also unknown how many workers may have had asthmatic conditions but did not report to the medical department in 1990. While recognizing the limitations of the Medical Department Daily Log as a surveillance tool, the number of employees reporting for reasons at least potentially indicative of asthma did not appear excessive for a workforce of this size.

The PMR study showed a statistically significant excess of all malignant neoplasms for white males but not for the other three race/sex groups. The overall PMR for all malignant neoplasms was not statistically significantly elevated. The lung was the most frequent cancer site, but the PMR for lung cancer was not statistically significantly elevated. The PMR is an estimate of the study group's mortality risk. If a study population is small, the estimate is statistically unstable. When only 28 deaths are being examined, a few missed deaths or inaccurate death certificates can

make a large difference in the outcome of the study. It is recognized, however, that the PMR may under- or over-estimate the true risk and does not take into consideration length of survival after employment.<sup>38</sup> The PMR differences also depend on company and labor union record keeping policies.<sup>38</sup> The lack of detailed individual work histories, including when the individuals started and left the company, jobs worked, and exposure history, preclude linking any specific material or job to the excess of all malignant cancer deaths. There were no data on smoking history, which is associated with an increased risk for lung cancer, for this study population. The company did have asbestos in the facility and used methylene chloride in the past, but there was not enough data available to connect these possible past exposures with the cancer deaths.

None of the PBZ or area air concentrations of respirable dust collected in the coffee and rice production areas exceeded current exposure limits. These criteria, however, are not appropriate for biologically active substances however, and will not protect against allergic responses to coffee dust. The results from the phosphine sampling are not interpretable due to the concentrations of phosphine detected on the back-up sections of the tubes and the field blanks. Parallel sampling conducted by the company showed barely detectable concentrations of phosphine.

## **VIII. RECOMMENDATIONS**

The following recommendations are offered to reduce workers' exposures to green coffee dust. NIOSH and OSHA recommend that engineering controls be used to control hazards to the extent feasible, followed by work practices, and, if necessary, personal protective equipment.

1. Employees with signs and symptoms of asthma, as identified by a nurse or primary physician, should be evaluated by a physician for occupational asthma. It is also important to identify those individuals with asthma or other medical conditions whose disease, although non-occupational in etiology, may be exacerbated by specific occupational exposures.
2. A medical surveillance program, with particular emphasis on respiratory disease, should be implemented using existing personnel and medical information, including the current pre-placement and periodic medical examination information.
3. Workers with asthma that is exacerbated by exposure to coffee dust should be offered a work assignment that would minimize coffee dust exposure. Drugs used to prevent or treat asthma symptoms should be considered an adjunct to, not a substitute for, minimizing potential exposure to the substances that cause the attacks.

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4. Workers should be informed of the potential health effects of working with coffee dust.
5. The maintenance staff should wear NIOSH/MSHA (Mine Safety and Health Administration) approved dust masks while working in the green coffee bean silos and scales.
6. A screw-type feeder system should be installed so that the vitamin mix dust does not have to be added by hand.
7. The current phosphine removal process should be continued.

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**XI. DISTRIBUTION AND AVAILABILITY OF REPORT**

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1. Maxwell House Coffee Inc., Houston, Texas
2. United Food and Commercial Workers International Union, AFL-CIO, Local Union 408, Houston, Texas
3. OSHA, Region VI, Dallas, Texas

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

**TABLE 1**

**Results for Respirable Dust in the Coffee Processing Areas**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040  
March 26-27, 1991**

<b>Job/Location</b>	<b>Sample Time</b>	<b>Sample Volume (liters)</b>	<b>Dust Concentration (TWA-mg/m<sup>3</sup>)*</b>
<i>Personal:</i>			
Process Oper./Coffee Roaster	8:30-2:29	610.3	0.07
Process Oper./Coffee Roaster	8:29-2:31	615.4	0.03
Process Oper./Coffee Roaster	8:32-2:26	601.8	0.10
Team Coord./Coffee Roaster	8:34-2:31	606.9	0.02
Team Coord./Green Coffee	7:05-2:24	746.3	0.17
Process Oper./Green Coffee	7:06-2:20	737.8	0.05
ITR Roaster/Green Coffee	7:03-2:25	751.4	0.07
Grinder/Green Coffee	7:04-2:23	746.3	0.05
<i>Area:</i>			
Green Coffee Dust Area	8:17-2:24	623.9	0.05
Silos-Green Coffee Area	7:12-2:22	731.0	0.03
OSHA PEL			5
ACGIH TLV			10 (Total)
Min. Detectable Concentration (MDC) Sample Volume: 602 liters			0.017

\* - TWA-mg/m<sup>3</sup> - Time-weighted average - milligrams per cubic meter

**TABLE 2**

**Results of Personal Breathing Zone and Area Samples for Respirable  
Dust (Vitamins) in the Rice Processing Areas**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040**

**March 26-27, 1991**

<b>Job/Location</b>	<b>Sample Time</b>	<b>Sample Volume (liters)</b>	<b>Dust Concentration (TWA-mg/m<sup>3</sup>)*</b>
<i><b>Personal:</b></i>			
Rice Cooker	9:02-2:54	598.4	0.07
Rice Cooker	7:21-2:45	754.8	0.01
<i><b>Area:</b></i>			
Vitamin Addition	8:47-2:57	629.0	0.03
Vitamin Addition	7:26-2:47	749.7	ND**
OSHA PEL			5
ACGIH TLV			10 (Total)
Min. Detectable Concentration (MDC) Sample Volume: 602 liters			0.017

\* - TWA-mg/m<sup>3</sup> - Time-weighted average - milligrams per cubic meter

\*\* - None Detected at MDC

**TABLE 3**

**1990 Medical Dispensary Log Entries\*  
Potentially Related to Asthma**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040**

<b>Log Entries</b>	<b>Number of Workers</b>
Hospitalization for asthma	2
Asthma attack without hospitalization	1
Hospitalization for unspecified pulmonary condition	2
Use of bronchodilator without mention of asthma	2
Allergy testing/injections	4
Chest pain/tightness	7
Lung congestion or wheezing	4
Cough without mention of acute respiratory illness	5
<b>TOTAL</b>	<b>27</b>

\* Each entry represents one worker.

**TABLE 4**

**Proportionate Mortality Ratio (PMR) Results for  
All Malignant Neoplasms<sup>^</sup>**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040**

<b>Race and Sex</b>	<b>Observed Deaths</b>	<b>Expected Deaths</b>	<b>PMR</b>	<b>LL#</b>	<b>UL##</b>
White Males	14	7	193*	105	324
Black Males	11	10	113	56	201
White Females	3	2	120	25	352
All Groups	28	20	138	92	200

<sup>^</sup> - Coded according to International Classification of Diseases (ICD), 9th Edition

#LL - Lower Limit, 95% Confidence Interval

##UL - Upper Limit, 95% Confidence Interval

\* - Statistically Significant

**TABLE 5**

**Malignant Neoplasms Frequencies by Race, Sex, and Site**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040**

<b>Race and Sex</b>	<b>Cause of Death</b>	<b>Observed Deaths</b>
White Males	Lung Cancer	4
	Prostate Cancer	3
	Liver Cancer	2
	Lymphoma	1
	Pancreatic Cancer	1
	Stomach Cancer	1
	Unspecified Cancer	1
Black Males	Lung Cancer	3
	Colon Cancer	3
	Brain Cancer	1
	Connective/Soft Tissue Cancer	1
	Lymphoma	1
	Multiple Myeloma	1
	Unspecified Cancer	1
White Females	Lung Cancer	2
	Unspecified Cancer	1

**TABLE 6**

**Proportionate Mortality Ratio (PMR) Results for  
Lung Cancer<sup>^</sup>**

**Maxwell House Coffee Company  
Houston, Texas  
HETA 91-0040**

<b>Race and Sex</b>	<b>Observed Deaths</b>	<b>Expected Deaths</b>	<b>PMR</b>	<b>LL#</b>	<b>UL##</b>
White Males	4	3	130	35	332
Black Males	3	4	78	16	229
White Females	2	1	363	44	1311
All Groups	9	8	118	54	225

<sup>^</sup> - Coded according to International Classification of Diseases (ICD), 9th Edition

#LL - Lower Limit, 95% Confidence Interval

##UL - Upper Limit, 95% Confidence Interval