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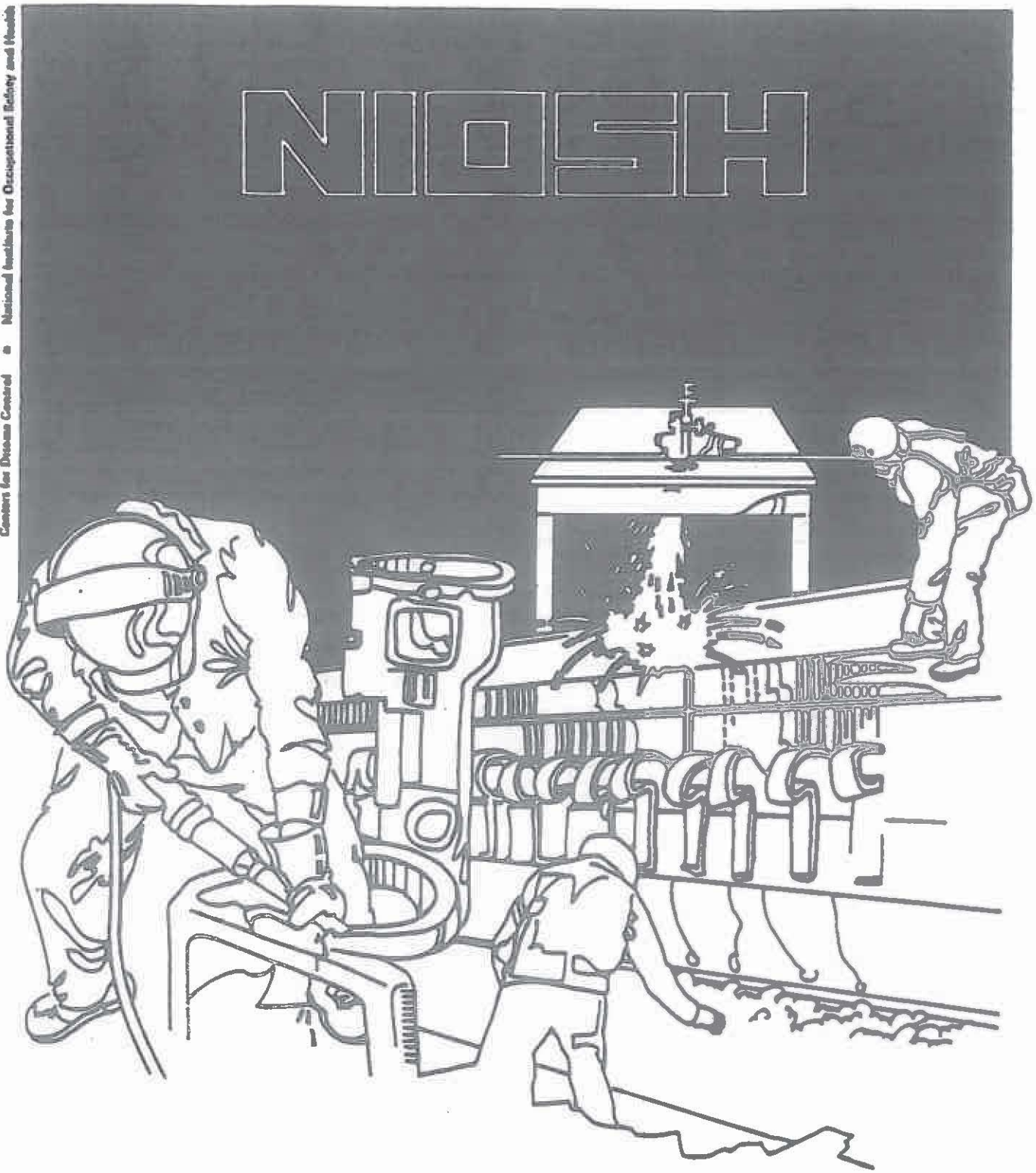

Health Hazard Evaluation Report

HETA 83-391-1683
CONTINENTAL COFFEE PRODUCTS COMPANY
HOUSTON, TEXAS

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 83-391- 1683
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CONTINENTAL COFFEE PRODUCTS COMPANY
HOUSTON, TEXAS

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I. SUMMARY

In August 1983, the National Institute for Occupational Safety and Health (NIOSH) was requested to evaluate the health status of employees at the Continental Coffee Products Company, Houston, Texas. The primary concern involved potential exposure to pesticide residues on imported coffee beans and, in particular, those pesticides banned in the United States because of their potential to cause cancer or adverse reproductive effects. An initial visit to the plant was made in September 1983, with follow-up evaluations conducted in November 1983 (environmental), and January 1984 (medical/environmental).

Long-term personal and area air sampling was conducted for total and respirable dust. Bulk dust samples were taken from various areas in the plant and analyzed for pesticide contamination. A medical questionnaire was developed and administered including questions for acute irritant and allergic symptoms and chronic respiratory conditions. For hourly workers, questions were also included on cancer and adverse reproductive effects.

Analysis of the air samples revealed the following concentration ranges, which are compared to their respective environmental criteria (EC): 29 personal respirable dust samples 0.03-2.03 mg/M^3 (EC-5.0 mg/M^3); 27 of 28 personal total dust samples, 0.09-2.65 mg/M^3 (EC-10.0 mg/M^3) with the additional sample reported at 11.95 mg/M^3; four (4) area respirable dust samples, 0.11-0.53 mg/M^3; and four (4) area total dust samples, 0.16-2.39 mg/M^3. The eight (8) bulk dust samples (green coffee bean area - 6; tea area - 2) showed low contamination of several different pesticides. Based on total dust levels and pesticide contaminants identified in the bulk samples, potential exposure levels were calculated using worst-case assumptions. All calculations indicated pesticide exposures significantly below acceptable daily intakes established by the United Nations Food and Agriculture Organization and the World Health Organization.

One hundred, thirty-two (132) of the 147 employees at the plant completed the NIOSH-administered questionnaire. This included 96 of the 106 production and maintenance workers. Only one (1) case of cancer and five (5) adverse reproductive outcomes were reported. Because of questionnaire difficulties, no conclusion could be drawn regarding the rates of chronic respiratory disease. Based on job-descriptions, employees were assigned to one of five "organic dust exposure categories". Although respirable and total dust concentrations were low, and within the environmental criteria, there were significant differences found in the distribution of reported acute irritant (possibly allergic) symptoms by exposure category. Employees with the greatest potential for exposure to coffee and tea dust reported acute symptoms two to four times as frequently as employees not exposed to organic dusts.

Based on the results of environmental sampling using "worst-case" assumptions, it would not be expected that employees would be exposed to pesticide levels posing any appreciable threat to health. There does, however, appear to be an increase in acute irritant (possibly allergenic) symptoms reported among those employees with the greatest potential for exposure to organic dusts. Recommendations for reducing this potential problem are included in this report.

KEYWORDS: SIC 209S (Roasted coffee), pesticides, organic dust, coffee blending, tea blending.

II. INTRODUCTION

On August 15, 1983, the National Institute for Occupational Safety and Health was asked by the International Chemical Workers Union (ICWU), on behalf of ICWU Local 770, to evaluate the health status of employees at the Continental Coffee Products Company facility in Houston, Texas. This request was prompted by concern that workers processing coffee at this plant might be exposed to residues of pesticides on imported coffee beans. Of particular concern was the possibility of exposure to pesticides that had been banned for use in the United States because of their potential to cause cancer or adverse reproductive effects.

In September 1983, NIOSH investigators met with plant management and union officials and conducted a walk-through survey of the facility. Non-directed medical interviews regarding possible acute or chronic health complaints were conducted with eight randomly selected employees from the coffee and tea processing areas.

Initially, green coffee bean samples from various countries were collected for analysis of their pesticide content. However, after reviewing the production processes observed during the walk-through inspection of the facility, it was apparent that only a few individuals had direct contact with green coffee beans. Any exposure to pesticide residues from the coffee or tea would be in the dust which arises during various stages of production. Therefore, we decided to pursue the question of possible pesticide exposures by collecting bulk dust samples from various areas in the plant for analysis of pesticide contamination. In addition, from observations made during the walk-through and from information obtained during the employee interviews, it seemed likely that the acute irritant (and possibly chronic) effects of exposure to the organic dust itself (in the tea as well as the coffee processing areas) could be a more significant health problem than exposure to pesticide contaminants in the dust.

In November 1983, a follow-up environmental evaluation was conducted, and in January 1984, a follow-up medical evaluation was conducted.

A preliminary letter, describing the findings of the walk-through survey, was sent on October 24, 1983, by the NIOSH investigators to plant management and to local and international union officials. An interim letter, summarizing the results of the pesticide analyses and organic dust exposure levels, was sent to them by the NIOSH investigators on June 5, 1984.

III. BACKGROUND

A. The Plant

Continental Coffee Products Company in Houston, Texas, is a division of CFS Continental, Inc., which purchased the roasting facility from Folgers in 1972. Folgers had operated the plant at its present location since 1939. At the time of this evaluation, the plant employed 147 people, including 106 production and maintenance personnel. Approximately 24 of the current hourly employees worked at this facility when it was owned by Folgers. When CFS Continental, Inc. bought the plant, the labor force was increased because of the introduction of more labor-intensive operations, mainly in the packaging areas.

The Houston facility processes approximately 60 million pounds of coffee per year. The green coffee beans are imported from a variety of countries, including Brazil, Colombia, Mexico, El Salvador, Ethiopia, Indonesia, Liberia, Ecuador, Peru, Guatemala, Costa Rica, Puerto Rico, and France. Typically, 17,000 - 22,000 (132 pound) sacks of coffee are in storage. The average length of time that any given shipment of coffee is in storage before processing is one to two weeks.

B. The Process

Green coffee beans in 132-pound sacks are unloaded from trucks in the 1st floor Shipping and Receiving area. At this point, one worker performs quality control checks on the shipment and controls the automatic palletizing of the sacks. The sacks of green coffee beans are then taken by elevator to the 3rd floor for storage. According to production demands, sacks of green coffee beans are transported by forklift from the 3rd floor storage area to the three dumpholes on the 3rd floor. Two dumpholes are used daily. Approximately 95% of the volume of green coffee beans is dumped manually into the larger dumphole. The sacks of green coffee beans are automatically raised on a pallet directly over the dumphole (which is surrounded by waist-high railings) to approximately the mid-chest level of the workers who stand around the dumphole. Three to five workers around the dumphole use knives to open the sacks, so that the beans fall through the dumphole to a conveyor on the 2nd floor below. The remaining portion of beans that does not fall out of the sacks by gravity after the sacks have been opened is swept out of the sacks by hand and the sacks are picked up at one end and shaken into the dumphole. The remaining 5% of green coffee bean volume is dumped manually by one worker into a smaller dumphole approximately 30 feet away. This employee positions a sack of green coffee beans at the edge of the dumphole (which is in the floor), opens the sack with a knife, tilts the sack so that the beans fall through the dumphole, and shakes the sack from the closed end so that the remaining beans are emptied from the sack. A third small dumphole

is used only for Mexican coffee beans, which arrive at the plant already roasted. The operation of the Mexican coffee dumphole is the same as for the small dumphole.

From the 3rd floor dumpholes, green coffee beans fall onto the 2nd floor conveyors, which automatically carry the beans back up to the 3rd floor cleaners. The cleaners have an internal vacuum system which suctions up light-weight contaminants of the beans, that is, chaff, dust, etc. The beans themselves are too heavy to be pulled into the vacuum and fall to the 2nd floor scalpers. The scalpers separate heavy waste materials (nails, stones, pieces of rope, etc.) from the beans. From the scalpers, green coffee beans are carried by an automatic conveyor system to the 5th floor storage bins. As required by production demands, green coffee beans are conveyed from the 5th floor storage bins to the blending screw on the 3rd floor. One worker operates the blender panel board, which is located adjacent to the larger 3rd floor dumphole. After blending, some green coffee beans are returned to the 5th floor storage bins, and some are stored in bins on the 3rd floor. The next operation is roasting. Green coffee beans are automatically conveyed from the 5th floor and 3rd floor storage bins to roasters on the 3rd or 5th floors. After roasting, beans may be stored or sent to the grinders on the 3rd or 4th floors. After the roasted coffee beans are ground, ground coffee is automatically conveyed to the 1st floor packaging area and packaged on the retail or institutional lines. The packaged roasted coffee (in cans or bags) is packed into boxes in the packaging area. The boxes are taken on pallets by forklift to the 1st floor warehouse area and loaded onto trucks for distribution.

Tea arrives at the plant ready for blending and packaging. Tea is stored and blended on the 3rd floor, then automatically conveyed from the 3rd floor blenders to the 2nd floor packaging area. The tea packaging is largely automated. Machines package the tea into bags, and tea packers work in the immediate vicinity mainly to box the bagged tea and to pack the boxes into cartons. In the same area, two machines are operated to package iced tea. The tea packaging area is separated from the rest of the 2nd floor by closed doors and is the only production area that is air-conditioned.

IV. EVALUATION DESIGN AND PROCEDURES

A. Environmental

1. Pesticide Residues

Eight bulk dust samples for pesticide analysis were taken from various locations in the coffee and tea areas in order to sample dust (1) at different stages of the coffee and tea processes, and (2) that would have accumulated for varying lengths of time. A total of six green coffee bean dust samples were taken from (1)

surfaces and dust collector systems on the 3rd floor (estimated to be at most 8 hours old), and (2) the 4th floor green coffee penthouse (estimated to be two days to weeks old). Two tea dust samples were taken from (1) the vacuum cleaner used to vacuum the iced tea machines and the filter in the tea room, and (2) the barrel inside the tea dust collector system on the 3rd floor (both samples estimated to be 5 days old). No predominantly roasted coffee dust samples were taken because studies done by the FDA have shown that pesticide residues found in green coffee bean samples were completely gone or remained only in trace amounts after the coffee was roasted.[1]

The bulk dust samples collected from various locations throughout the plant were analyzed for a variety of chlorinated hydrocarbon pesticides. The analytical methods had the following limits of detection: 0.02 ug/g for aldrin, alpha -BHC, beta -BHC, delta -BHC, DDD, DDE, o,p' -DDT, dieldrin, endrin, endosulfan I, endosulfan II, heptachlor and lindane; 0.2 ug/g for chlordane; and 1 ug/g for toxaphene.

2. Environmental Coffee/Tea Monitoring

   a. Personal breathing-zone total and respirable dust samples in the coffee and tea handling/production areas were collected by using Mine Safety Appliance (MSA) battery-operated vacuum pumps with 37-millimeter diameter, 5.0 micron pore size poly vinyl chloride filters (plus a 10-millimeter cyclone collector for respirable samples), at a sampling rate of 1.7 liters per minute (lpm).

   b. General area total and respirable high-volume dust samples in the tea room and around the large/small coffee "dumpholes" were collected by using GAST oil-less vacuum pumps with 37-millimeter diameter, 5.0 micron pore size, poly vinyl chloride filters (plus regular stainless steel cyclone collector for respirable samples), with critical orifices at sampling rates varying from 8.9-9.7 liters per minute (lpm).

B. Medical

All employees were invited to participate in a questionnaire interview survey. Since the request concerned cancer and adverse reproductive effects, the questionnaires for hourly workers included questions about these effects. For purposes of this evaluation, management and supervisory personnel were of interest primarily as a comparison group for acute irritant and allergic symptoms and chronic respiratory conditions. Therefore, management and

supervisory personnel were not asked about reproductive outcomes unless their job duties required them to spend 10 or more hours per week in the production areas. All employees (hourly, supervisory and management personnel) were asked questions about their occupational history, acute irritant and allergic symptoms, and chronic respiratory conditions. For symptoms identified by the study participants as being work-related, employees were asked what they thought was the cause of the symptoms.

For purposes of analyzing frequency rates for the symptoms and medical conditions of interest, employees were assigned to one of five "organic dust exposure categories", based on their job descriptions:

Exposure category	Definition of category
Management & office	All persons, salaried & hourly, who indicated they spend the majority of their time in office work: clerks, secretaries, receptionists, accountants, computer personnel. This category also includes supervisors and executive management personnel who spend less than 10 hours per week in production areas.
Shipping & Warehouse	All persons working in the shipping & warehouse areas, including supervisors & management personnel, and custodians & maintenance personnel who spend the majority of their time in these areas. This category also includes maintenance personnel who work primarily in the basement and spend less than 10 hours per week in production areas.
Packaging	All persons in retail and institutional packaging, including quality control personnel, supervisors & management personnel, and custodians & maintenance personnel who spend the majority of their time in the 1st floor packaging areas. This category also includes the few individuals who work on the 2nd floor printing boxes or as material handlers.

Coffee	All persons working on the 2nd, 3rd, 4th and 5th floors who have potential exposure to green coffee bean dust and/or roasted coffee bean dust. Employees included in this category were the following: -employees who work around the 2nd floor scalpers -employees who work around the 3rd floor dumpholes -3rd floor forklift drivers -3rd floor roaster & grinder operators -remix operators (The remix operation was still located on the 4th floor at the time of this survey.) -4th and 5th floor grinder and roaster operators -quality control personnel, supervisors & management personnel, and custodians & maintenance personnel who spend the majority of their time on these floors -maintenance personnel who work primarily in the basement but spend 25-50% of their time on these production floors (10 or more hours per week).
Tea	All persons working in the 2nd floor tea packaging area. This also includes custodians, maintenance personnel and supervisors who work in the tea dumphole or packaging areas.

V. EVALUATION CRITERIA

A. Environmental

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Airborne substances sampled for in this study and their relevant environmental exposure criteria are shown below.

Permissible Exposure Limit (TWA)

Substance	ACGIH(mg/M^3)*	OSHA(mg/M^3)
Respirable Inert Nuisance Dust	5	5
Total Inert Nuisance Dust	10**	15

* $mg/M3$ = milligrams of substance per cubic meter of air sampled
** For those nuisance particles containing less than 1% quartz

B. Toxic Effects

1. Pesticide Residues

According to a 1979 report by the General Accounting Office, many pesticides whose use has been banned or heavily restricted in the United States are still produced in this country and exported to foreign countries.

The legal authorities for pesticide regulation within the United States are the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947 (7 U.S.C. 135), as amended, and the Federal Food, Drug and Cosmetic Act (FFDCA) of 1938 (21 U.S.C. 301) as amended. FIFRA as amended requires that the Environmental Protection Agency (EPA) register all pesticides before distribution, sale, or use in the United States....A pesticide produced solely for export is not required to be registered with EPA and may be exported regardless of its U.S. regulatory status or the appropriateness of its intended use.....In 1976 domestic producers exported over 552 million pounds, of which 25 percent were unregistered. Twenty-eight percent of these exports were for Latin American countries from which we obtain 38 percent of all imported agricultural commodities.....In some foreign countries pesticides known or suspected of causing cancer, birth defects, and gene mutations are carelessly or excessively used.[2]

It is known that coffee beans can be contaminated with a variety of pesticide residues.[1,2] Because of the propensity of organochlorine pesticides to accumulate in humans and animals and their potential for causing cancer or adverse reproductive outcomes, they are the pesticides of most concern to this hazard evaluation. (DDT is probably the best known pesticide of this type.)

The United Nations Food and Agriculture Organization and the World Health Organization (FAO/WHO) have established "acceptable" daily intakes for some pesticides.[3,4] These recommended limits are intended to allow a considerable safety factor for the possible cumulative effects of dietary consumption of pesticides that are known or suspected to be mutagenic, carcinogenic, or cause long-term health effects such as delayed neurotoxicity. The FAO/WHO acceptable daily intakes for the chlorinated hydrocarbon insecticides are the "exposure" levels used as reference values for this evaluation because they attempt to address the risk of years of low-level exposure, which is the situation for employees at Continental Coffee. Acceptable daily intakes are listed in Table 4 for the pesticides found in detectable quantities in this evaluation.

2. Coffee Dust

For compliance purposes, coffee and tea dust are considered nuisance dusts. However, it has been reported that at levels well within the OSHA standards (5 mg/M^3 for respirable dust and 15 mg/M^3 for total dust), exposure to organic dusts can cause acute irritant or allergic upper and lower respiratory symptoms. Occupational allergic symptoms and respiratory disease have been documented in workers exposed to coffee and tea dust, including workers who were not known to have other allergies.

Kay[5] reported on a study of 112 workers at a coffee manufacturing plant. Twenty-seven (27) workers had allergic symptoms attributed to their exposures to green and roasted coffee and positive skin tests to coffee chaff and beans. None of the new employees or clerical workers had positive skin tests or allergic symptoms. The rate of positive skin tests was higher among symptomatic exposed workers than among asymptomatic exposed workers. The greatest number of workers had positive skin tests for green chaff and coffee beans rather than roasted chaff and beans. These results suggest that the allergic potential of coffee beans and chaff is greatly reduced during roasting. No environmental monitoring was done to document dust exposure levels.

In a study comparing 45 non-smoking female coffee workers with 45 non-smoking female soft-drink production workers, the prevalence of all chronic respiratory symptoms was significantly higher in the coffee workers than in the control subjects.[6] Mean total dust concentration was 11.2 mg/M^3 (range: 1.4-62.3 mg/M^3) in the green coffee processing areas and 4.3 mg/M^3 (range 1.1-8.8 mg/M^3) in the roasted coffee processing areas. The percent respirable fraction for green coffee was 3% and for roasted coffee was 2%. Coffee workers with positive skin tests to coffee allergens had a significantly higher prevalence of chronic cough and phlegm than workers with negative skin tests.

In a study[7] of 372 coffee processing plant workers exposed to relatively low total green, mixed and roasted coffee dust (0.48 mg/M^3 or less), prevalences of lower respiratory symptoms (regular cough, phlegm, wheezing, breathlessness) and chronic bronchitis did not differ significantly among the exposure areas. The plant-wide prevalence of asthma was relatively low and comparable to workers not exposed to occupational allergens. However, values significantly lower than predicted for one-second forced expiratory volume (FEV_1) were found in workers with more than five years of employment (regression coefficient, -0.011 liter/year employed, $p < 0.05$). Also, workers with serologic

evidence of sensitization to green coffee had an average FEV_1 244 ml below predicted. This study demonstrates that even in the absence of an excess rate of occupational bronchitis or asthma cases, an exposure-related excess decline in lung function can be demonstrated in workers with relatively low exposures to coffee dust.

Van Toorn[8] published a case report of a man with no previous history of allergies who developed extrinsic allergic alveolitis (a pneumonia-like illness caused by an organic dust) after working for more than 20 years in a coffee processing plant.

3. Tea dust

Respiratory disease in workers occupationally exposed to dusts generated during the processing of tea was first described in 1919 by Castellani.[9] He noted that workers in the tea factories of what was then known as Ceylon suffered poor health and fatigability, and developed a chronic productive cough. If the workers left the factory and went to work in the fields, all the symptoms slowly disappeared. Castellani named this entity "tea factory cough" and "tea tasters disease".

The next reference to occupational respiratory disease in the tea industry appeared in 1970. Uragoda[10] described a case report of a tea maker in Ceylon who, after 23 years of occupational exposure, developed classic occupational asthma related to entering the sifting or packaging room. He had a positive immediate-type skin test to tea fluff, the fine dust discharged into the air mainly during the sifting process but also during packaging. Several minutes following a provocative inhalation of tea fluff he had onset of difficulty breathing, with wheezing and cough.

A survey of pulmonary function in workers at two tea bagging factories has been reported by Grandjean, Hotz and Lob.[11] They found significantly lower expiratory flows (FEF_{25-75}), attributable to tea dust exposure, in the 59 women studied. They hypothesized that this flow abnormality may be related to chronic bronchitis induced by the inhalation of dust.

In 1979, NIOSH investigators conducted an environmental and medical survey of 206 employees at an herbal tea manufacturing facility.[12] They concluded that respiratory exposure to airborne tea dusts can cause symptomatic chronic cough and chronic bronchitis, and may in some individuals cause acute chest tightness associated with measurable decreases in pulmonary function over the work shift.

VI. RESULTS AND DISCUSSION

A. Environmental

1. Pesticide Residue Exposure

The following pesticides were not found in any sample in concentrations above their respective limits of detection (LOD): aldrin, alpha -BHC, beta -BHC, delta -BHC, endrin, endosulfan I, endosulfan II (LOD, 0.02 ug/g); chlordane (LOD, 0.2 ug/g); toxaphene (LOD, 1 ug/g). Only trace concentrations of the other pesticides were measured (Table 3). Lindane and heptachlor were each found in one coffee sample. Dieldrin was found in four coffee samples and one tea sample. The DDT isomers were the most frequently detected pesticides: o,p' -DDT was also found in the highest concentration, 2.9 ug/g. DDE, a metabolite of DDT, was found in one coffee and one tea sample.

In order to determine the amount of potential exposure to pesticide contaminants in the dust, we calculated potential exposures assuming "worst-case" conditions (see Appendix A for details). The acceptable daily intake established by the FAO/WHO for DDT is 0.005 mg per kg of body weight, or 350 ug per day for a 70 -kg (154 pound) person and 250 ug per day for a 50-kg (110-pound) person. The highest potential daily exposure to DDT is in the range of 0.1 ug, a level that is 2500 to 3500 times lower than the allowable dietary intake. Similar calculations were performed for the other detected pesticides (dieldrin, heptachlor and lindane). The maximum potential daily exposures for these pesticides are also 100 or more times lower than their respective FAO/WHO levels for acceptable daily intake (Table 4).

2. Environmental Coffee/Tea Monitoring

Results from personal breathing-zone total and respirable dust concentrations are shown in Table 1. For the twenty-nine (29) respirable dust samples, the concentrations ranged from 0.03-2.03 mg/M^3. Twenty-seven (27) of the twenty-eight (28) total dust samples were in the range of 0.09-2.65 mg/M^3, with an additional sample being reported at 11.95 mg/M^3. This latter sample, based on the activity being conducted, and results of other samples collected at the same time, is felt to be invalid. Table 2 reflects the results from the general area dust monitoring. The area respirable dust samples ranged from 0.11-0.53 mg/M^3, and the area total dust samples from 0.16-2.39 mg/M^3. With the exception of the one previously-mentioned sample determined to be invalid, all others were well below both ACGIH and OSHA evaluation criteria. In those work areas where the coffee and tea are handled, the dust samples collected are assumed to consist primarily of organic dust.

B. Medical

In January 1984, three NIOSH physicians administered medical questionnaires to 132 of 147 employees (90%), including 96 of 106 hourly (production and maintenance) workers (Table 5).

Demographic characteristics of each exposure category and the total study group are given in Table 6. The mean age for all study participants was 39 years, which was similar in all the exposure categories except for the "shipping and warehouse" workers, whose mean age was 45 years. In the total group, 77% were men and 23% were women. The gender distribution varied in the exposure categories from 58% women in the "tea" category to no women in the "shipping and warehouse" group. The overall mean duration of employment at this plant was 9 years, ranging from 4.2 years (management and office) to 17 years (shipping and warehouse). The overall racial distribution was: 58% white, 19% black, 22% Hispanic, 1% Asian. The racial distribution was similar in the "shipping and warehouse", "packaging", and "coffee" categories, but the "management and office" category had fewer Hispanics and no blacks, and the "tea" group had relatively more blacks and Hispanics.

Only one of the 132 employees interviewed reported having been diagnosed with cancer. Only five of the study participants reported adverse reproductive outcomes occurring during their employment at Continental Coffee: (1) one employee with impaired fertility; (2) one female employee who had miscarried in 1979; (3) one male employee whose wife had miscarried in 1975 and 1978; (4) one male employee whose wife had miscarried in 1978; and (5) one male employee whose wife had miscarried twice in the year prior to the interview.

It was not clear from some of the responses whether cough and sputum production were caused by chronic chest symptoms (consistent with upper respiratory tract conditions). The number of people reporting chronic respiratory conditions, such as cough, bronchitis and breathlessness, was very low and/or did not differ substantially between exposure categories. Only three (2%) of the 132 employees reported episodes of wheezing.

Study participants were asked about acute irritant/allergic symptoms that occurred during their usual work activities. Symptoms analyzed included: eye irritation (itchy, watery or burning eyes), nasal symptoms (nose irritation or congestion), throat irritation (dry, tickling or scratchy throat), sinus pain or congestion, rash and headache. Reported symptoms were analyzed for each organic dust exposure category (Table 7).

There were twelve employees in the "tea" category. Seven employees (58%) reported eye irritation; five (42%) reported nasal symptoms; four (33%) reported throat irritation. Three (25%) employees reported headache and three reported sinus symptoms. Only one person (8%) reported rashes, attributed by the employee to iced tea dust. In this category, 45% of all symptoms were attributed to tea dust and 32% were attributed specifically to iced tea dust. Three complaints were attributed to "certain tea batches", but the employees could not specify which brands. For the remaining two symptoms, employees did not specify a specific cause.

Of the 29 employees in the "coffee" exposure category, nine (31%) reported eye irritation; nine reported throat irritation; eight (28%) reported nasal symptoms. Less frequently reported symptoms were rash (four people), headache (three people), and sinus symptoms (two people). In the "coffee" exposure category, 49% of all symptoms were attributed to "coffee dust" (not specifying green or roasted), 25% of all symptoms to "green bean dust", 14% of all symptoms to "smoke from the roasters", and the balance to miscellaneous causes.

Fifty-one employees were in the "packaging" category. Eleven employees (22%) reported headaches; eleven (22%) reported throat irritation; ten (20%) reported sinus symptoms. Eight employees (16%) reported nasal symptoms; seven (14%) reported eye irritation; two (4%) reported rashes. "Coffee dust" was the cause specified for 43% of all complaints, and "dust" (unspecified) accounted for another 16% of reported symptoms. Other causes given included: box dust (6%), noise (6%), stress (2%). No cause was specified for 27% of the symptoms reported.

Of the thirteen people in the shipping and warehouse category, no one reported work-related rashes or sinus pain/congestion. One person (8%) reported throat irritation and one person reported nose irritation; both workers attributed their symptoms to dust from the loading docks on windy days. Two people (15%) reported eye irritation, also attributed to loading dock dust. Two people (15%) reported headaches at work, but did not note a specific cause.

There were 27 employees in the "management and office" category. The most frequent complaint from individuals in this group was headache (eleven persons, or 41%). Four people (15%) reported nasal symptoms, and two (7%) reported eye irritation. Only one person reported sinus symptoms and no one reported rashes or throat irritation. "Stress", "tension", or "pressure" were the causes given for 39% of all reported symptoms. Two symptoms (11%) were attributed to eyestrain. For four (22%) of the reported symptoms, no cause was given. Miscellaneous causes of

symptoms, noted once each, included: uncomfortable office temperatures, cigarette smoke, dust on the floors and desks. Two individuals whose work requires them to spend short periods of time in production areas cited tea dust and coffee dust as causes for nasal stuffiness and eye irritation respectively.

VII. CONCLUSIONS

A. Pesticide Residue Exposure

Our analysis confirmed previous documentation that coffee beans can be contaminated with various chlorinated hydrocarbon pesticides. Employees at Continental Coffee Products, Inc. are thus exposed to these pesticides (as contaminants in the organic dust), but at estimated levels which are so low that they would not be expected to pose any appreciable threat to health.

B. Coffee and Tea Dust Exposures

Because of difficulties with the questionnaire and the inability to distinguish chronic chest versus chronic sinus conditions as the cause of cough or phlegm (sputum) production, no conclusions can be drawn regarding rates of chronic respiratory disease. Fortunately, the overall number of people reporting cough, phlegm production, breathlessness, bronchitis, or wheezing did not seem excessive and did not differ substantially among exposure categories.

Although the environmental monitoring results did not reveal high levels of respirable or total dust in any area of the plant, there is a noticeable difference in the prevalence of acute eye and upper respiratory tract symptoms reported by people in the "coffee", "tea", and "packaging" exposure categories compared to the "shipping and warehouse" and "management and office" categories. The highest dust exposures documented for workers in the second-floor tea packaging area were 0.12 mg/M^3 for respirable dust and 0.88 mg/M^3 for total dust.

This group, nonetheless, had the highest rate of reported acute irritant symptoms. Environmental monitoring of individuals whose job duties placed them in the "coffee" exposure category revealed that, as a group, they have the highest total dust exposures. Of the 16 individuals in this category who were monitored, 11 (69%) had total dust exposures of 0.50 mg/M^3 or higher. Their rate of symptom reporting was consistent with the environmental monitoring results. In both the "tea" and "coffee" categories, symptoms were overwhelmingly attributed, by the affected workers, specifically to the organic dust exposure; 77% of all symptoms reported by employees in the "tea" category were attributed, by the affected workers, to tea dust, and 74% of all symptoms reported by the "coffee" group were attributed, by the affected workers, to some form of coffee dust.

In the packaging area, 0.35 mg/m^3 was the highest representative total dust level measured for an employee. (One employee in this area had the highest dust levels for respirable and total dust of any area: 2.03 mg/M^3 for respirable dust and 2.65 mg/M^3 for total dust. However, this employee reported working on a machine that was repeatedly malfunctioning on the day the environmental monitoring was performed. These notably higher levels could be considered a predictor of potentially higher exposures to employees during machine malfunctions but cannot be considered representative of the dust levels to which most workers are usually exposed.) The "packaging" category employees complained of acute symptoms less than the "tea" or "coffee" employees but substantially more than the "shipping and warehouse" employees. Additionally, at least 43% of the symptoms in the packaging area were attributed specifically to coffee dust; another 16% of symptoms were attributed to "dust", but the type was not specified.

The low reported symptom prevalence among the employees in the shipping and warehouse areas is consistent with their perception of little or no organic dust exposures. Only the employee who performs quality control checks on the sacks of green coffee beans as they arrive at shipping and receiving has much potential for exposure to green coffee beans/dust; he was the only one monitored for dust exposure. His respirable and total dust levels were extremely low: 0.07 mg/M^3 and 0.10 mg/M^3, respectively. The other workers in the shipping area indicated in their medical interviews that they do not consider themselves exposed to coffee beans or dust in any significant amount. As with the shipping department, only one worker in the warehouse was monitored for dust exposure, since the employees in the warehouse area do not have any apparent exposure to coffee or tea dust. The total dust level on the warehouse worker monitored was 0.22 mg/M^3. This represents dust from the loading docks, which is not likely to be composed mainly of coffee or tea dust. The fact that this total dust level is in the same absolute range as the total dust levels measured in the packaging areas may further highlight differences in the potential irritant or allergic effects of specific organic dusts compared to general environmental (multiple-source) dusts. Given the same levels of dust exposure, workers in the packaging area (who are exposed to coffee dust) reported symptoms twice as often as workers in the shipping and warehouse areas (who are not exposed to coffee or tea dust).

No environmental monitoring was performed on employees in the "management and office" category, because they have no specific organic dust exposure (except for a few individuals who spend less than 10 hours per week in production areas). The most frequently reported symptom in this group was headache. When a suspected cause was given, headaches reported by management and office personnel were attributed to "stress, tension, or pressure" (7 people) and "eyestrain) (one person). By contrast, all three of the people in the "coffee" category

who reported headaches said their headaches were caused by sinus congestion which resulted from exposure to coffee dust. One of the three employees in the tea area who complained of headaches at work attributed them to sinus congestion from iced tea dust.

In summary, there were significant differences in the distribution of acute irritant (possibly allergic) symptoms reported by exposure category. Employees with the greatest potential for exposure to coffee and tea dust reported acute symptoms two to four times as frequently as employees not exposed to organic dusts, in spite of the fact that the measured total dust levels were low. There is no evidence presently of an excess rate of chronic respiratory disease or occupational asthma in employees at Continental Coffee, but the potential for loss in respiratory function is not confined to individuals who develop overt symptoms of bronchitis or asthma. It should not be concluded that the coffee, tea and packaging employees who complain of acute irritant and upper respiratory symptoms are simply "allergy-prone individuals". Many of the symptom prevalence rates reported in these categories of workers are higher than one would predict based on the presumption that approximately 10% of the general population is allergic. Also, an allergic hypersensitivity reaction in the lungs (extrinsic allergic alveolitis) can develop after exposure to organic dust in individuals with no previous history of allergies.

VIII. RECOMMENDATIONS

Since a substantial portion of the acute symptoms reported by the employees appear to be related to organic dust exposures, which can relate to the development of extrinsic allergic alveolitis in individuals with no previous history of allergies, efforts should be made to lower the dust levels in the coffee and tea production and packaging areas. Approaches could include:

1. increased use of local exhaust ventilation, especially in the pouring operations;

2. improved work practices to reduce the generation of dust and its accumulation;

3. increased ventilation in the basement re-mix operation; and

4. employee training directed toward the understanding of potential hazards and the employees' role in controlling dust exposure(s).

IX. REFERENCES

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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati, Ohio, address.

Copies of this report have been sent to:

1. International Chemical Workers Union, Local 770
3. Continental Coffee Products Company, Houston, Texas
3. U.S. Department of Labor, OSHA - Region VI
4. NIOSH - Region VI

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place, accessible to the employees, for a period of thirty (30) calendar days.

Table 1

Personal Total and Respirable Dust Concentrations

Continental Coffee Products Company
Houston, Texas
HETA #83-391

* Sample Number	Date Sample Collected	Location	Sampling Period	** Concentration (mg/M^3)
9052(T)	11-16-83	Green Bean Batch Roaster Dumper	1010-1647	0.42
9065(R)	"	"	"	0.31
9042(T)	11-16-83	Green Coffee Receiving	1010-1647	0.10
9067(R)	"	"	"	0.07
9037(T)	11-16-83	Tea Line 92, Packer B	1018-1650	0.40
9066(R)	"	"	"	0.12
9039(T)	11-16-83	Tea Line 97, Packer B	1020-1645	11.95
9069(R)	"	"	"	0.42
9043(T)	11-16-83	Green Bean Blender Operator	1021-1548	0.20
9075(R)	"	"	"	0.06
9054(T)	11-16-83	Forklift Operator, Beans to Large Dumphole	1024-1700	0.33
9045(R)	"	"	"	0.21
9056(T)	11-16-83	Green Bean Dumper	1025-1635	0.65
9058(R)	"	"	"	0.33
9059(T)	11-16-83	Green Bean Dumper	1027-1640	0.64
9074(R)	"	"	"	0.21
9046(T)	11-16-83	Tea Dumper/Material Handler	1030-1645	0.29
9070(R)	"	"	"	0.04

9047(T)	11-16-83	Custodian, 3rd Floor	1031-1642	0.95
9068(R)	"	"	"	0.09
9053(T)	11-16-83	Tea Line 95, Packer B	1033-1650	0.88
9076(R)	"	"	"	0.12
9041(T)	11-16-83	Pre-roasted Coffee Dumper, 3rd floor	1035-1635	0.83
9063(R)	"	"	"	0.06
9049(T)	11-16-83	Grinder Operator, 3rd floor	1037-1649	0.13
9071(R)	"	"	"	0.05
9389(T)	11-17-83	Batch Roaster Operator, 3rd floor	0836-1553	0.11
9072(R)	"	"	"	0.07
9080(T)	11-17-83	Batch Roaster Operator, 5th floor	0837-1557	1.63
9380(R)	"	"	"	0.11
9374(T)	11-17-83	Re-mix Operator, 4th floor	0841-1556	0.64
9034(R)	"	"	"	0.05
9383(T)	11-17-83	Custodian, 2nd floor	0846-1613	0.76
9061(R)	"	"	"	0.12
9385(T)	11-17-83	Grinding Operator, 4th floor	0850-1554	0.39
9382(R)	"	"	"	0.14
9040(T)	11-17-83	Custodian, 4th floor	0851-1555	0.91
9370(R)	"	"	"	0.16
9381(T)	11-17-83	Maintenance, 2nd, 3rd, 4th, 5th floors	0853-1454	0.80
9060(R)	"	"	"	0.08
9377(T)	11-17-83	Kiwi Coder	0900-1544	0.57
9062(R)	"	"	"	0.10
9379(T)	11-17-83	Machinist, Machine Shop/Basement	0901-1545	0.52
9079(R)	"	"	"	0.03
9081(T)	11-17-83	Warehouse Leadman	0917-1604	0.22
9035(R)	"	"	"	0.04
9388(T)	11-17-83	Institutional Packaging, Hesser Line	0932-1447	2.65
9078(R)	"	"	"	2.03
9375(T)	11-17-83	Institutional Packaging, Filler Pouch Line 37	0934-1601	0.23
9387(R)	"		"	0.11

9372(T)	11-17-83	Institutional Packaging, Line 27	0935-1602	0.09
9038(R)	"	"	"	<0.07
9384(R)	11-17-83	Institutional Packaging, Lines 19-20	1050-1556	0.09
426(T)	1-25-85	Tea Machine #98	0755-1448	1.47
429(R)	"	"	"	0.39
425(T)	1-25-85	Tea Machine #97	0758-1448	1.93
421(R)	"	"	"	0.39

U.S. Department of Labor, Occupational Safety and Health.....	(T)	15.0
Administration (OSHA), 8-hour, time-weighted average	(R)	5.0

*(T) - Total; (R) - Respirable

** mg/M^3 - milligrams of total/respirable dust per cubic meter of air sampled

Table 2

General Area Total and Respirable Dust Concentrations

Continental Coffee Products Company
Houston, Texas
HETA #83-391

* Sample Number	Date Sample Collected	Location	Sampling Period	** Concentration (mg/M^3)
9051(T)	11-16-83	Large Dumphole	1134-1800	2.39
9073(R)	"	"	"	0.50
9057(T)	11-16-83	Small Dumphole	1142-1800	1.22
9044(R)	"	"	"	0.53
9048(T)	11-16-83	Tea Room	1118-1800	0.16
9064(R)	"	"	"	0.11
9050(T)	11-17-83	Tea Room	1008-1610	0.43
9036(R)	"	"	"	0.18

U.S. Department of Labor, Occupational Safety and Health.....	(T)	15.0
Administration (OSHA), 8-hour, time-weighted average	(R)	5.0

*(T) - Total; (R) - Respirable
**mg/M^3 - milligrams of total/respirable dust per cubic meter of air sampled

Table 3

Concentrations of Pesticides Detected in Dust Samples

Continental Coffee Products Company
Houston, Texas
HETA #83-391

November 1983

Sample type	Pesticides Detected, Concentrations in ug/g					
	Dieldrin	o,p'-DDt	p,p,'-DDT	DDE	Heptachlor	Lindane
1. Coffee	1.1	- *	-	-	-	-
2. Coffee	0.09	-	0.11	-	-	-
3. Coffee	-	0.04	0.31	0.02	-	-
4. Coffee	0.04	-	0.13	-	0.01	0.06
5. Coffee	-	0.04	2.9	-	-	-
6. Coffee	0.07	0.04	0.08	-	-	-
7. Tea	0.06	0.04	0.38	-	-	-
8. Tea	-	0.10	1.3	0.06	-	-

*Indicates that the pesticide concentration in that sample was below the limit of detection

Table 4

Calculated Daily Exposures for Pesticides Detected in Factory Dust

Continental Coffee Products Company
Houston, Texas
HETA #83-391

November 1983

	Dieldrin	Heptachlor	Lindane	DDT isomers & metabolites
Highest measured concentration in a dust sample (in micrograms per gram)	1.1	0.1	0.06	3.06
FAO/WHO acceptable daily intake				
1. microgram per kg of body weight per day	0.1	0.5	10	5
2. microgram per day for 70 kg person	7.0	35	700	350
3. microgram per day for 50 kg person	5.0	25	500	250
Highest potential daily exposure (based on total dust exposure of 2.65 mg/M^3), in micrograms/day	0.029	0.0027	0.0016	0.081

Table 5

Continental Coffee Products Company
Houston, Texas
HETA #83-391

January 1984

Job Category	No. on Payroll	No. and Percent Interviewed	
Production & maintenance	106	96	91%
Hourly non-production, salaried, office & management	41	36	88%
TOTAL	147	132	90%

Table 6

Demographic Characteristics of Study Participants

Continental Coffee Products Company
Houston, Texas
HETA #83-391

January 1984

Exposure Category	No. persons	Mean age in years (range)	Men No. (%)	Women No. (%)	White No. (%)	Black No. (%)	Hispanic No. (%)	Asian No. (%)	Mean duration of employment in years (range)
Management & office	27	37 (23-62)	14 (52)	13 (48)	22 (81)	0 (1)	4 (15)	1 (4)	4.2 (1 mo-33 yrs)
Warehouse & shipping	13	45 (26-62)	13 (100)	0 (-)	6 (46)	3 (23)	4 (31)	0 (-)	17 (1.5-39 yrs)
Packaging yrs)	51	38 (20-65)	42 (82)	9 (18)	25 (49)	11 (22)	14 (27)	1 (2)	8.7 (4 mos-42.5
Coffee	29	39 (24-64)	27 (93)	2 (7)	16 (55)	7 (24)	6 (21)	0 (-)	11 (1-38 yrs)
Tea yrs	12	39 (29-55)	5 (48)	7 (58)	7 (58)	4 (33)	1 (8)	0 (-)	7.7 (2 mos-32.5
Total	132	39 (20-65)	101 (77)	31 (23)	76 (58)	25 (19)	29 (22)	2 (1)	9 (1 mo-42.5 yrs)

Table 7

Frequency of Symptoms Reported by Exposure Category

Continental Coffee Products Company
Houston, Texas
HETA #83-391

January 1984

Exposure Category	No. in category	Eye irritation No. (%)	Nose irritation or congestion No. (%)	Throat irritation No. (%)	Sinus pain or congestion No. (%)	Rash No. (%)	Headache No. (%)
Tea	12	7 (58)	5 (42)	4 (33)	3 (25)	1 (8)	3 (25)
Coffee	29	9 (31)	8 (28)	9 (31)	2 (7)	4 (14)	3 (10)
Packaging	51	7 (14)	8 (16)	11 (22)	10 (20)	2 (4)	11 (22)
Shipping & warehouse	13	2 (15)	1 (8)	1 (8)	0 (0)	0 (0)	2 (15)
Management & office	27	2 (7)	4 (15)	0 (0)	1 (4)	0 (0)	11 (4)

Appendix A

Sample Calculation of "Worst-Case" Conditions for Pesticide Contaminants in Dust

AMOUNT OF PESTICIDE EXPOSURE PER DAY =

(Concentration of total dust in the air) X (Concentration of pesticide in the dust) X (Amount of air breathed during an 8-hour shift)

As an example, the highest possible daily pesticide exposure for DDT and its isomers and metabolites would be as follows:

(1) The highest measured concentration of total dust for any sample was 2.65 mg/M^3.

(2) The highest measured concentration of a pesticide in the dust samples was for the DDT isomers and metabolites:

o,p'-DDT	0.10 ug/g
p,p'-DDT	2.90 ug/g
DDE	0.06 ug/g
TOTAL	3.06 ug/g

(3) The estimated amount of air breathed in during 8 hours of typical work at this plant is 10 cubic meters per day (m3/day).

Therefore:

$$2.65 \frac{mg}{m3} \times 3.06 \frac{ug}{g} \times 10 \frac{m3}{day} \text{ equals } 81 \frac{ng}{day} \text{ or } 0.081 \frac{ug}{day}$$

= 81 nanograms per day

OR

0.081 micrograms per day

1 milligram (mg) = 1 X 10^{-3} gram (g)

1 microgram (ug) = 1 X 10^{-6} gram

1 nanogram (ng) = 1 X 10^{-9} gram

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