U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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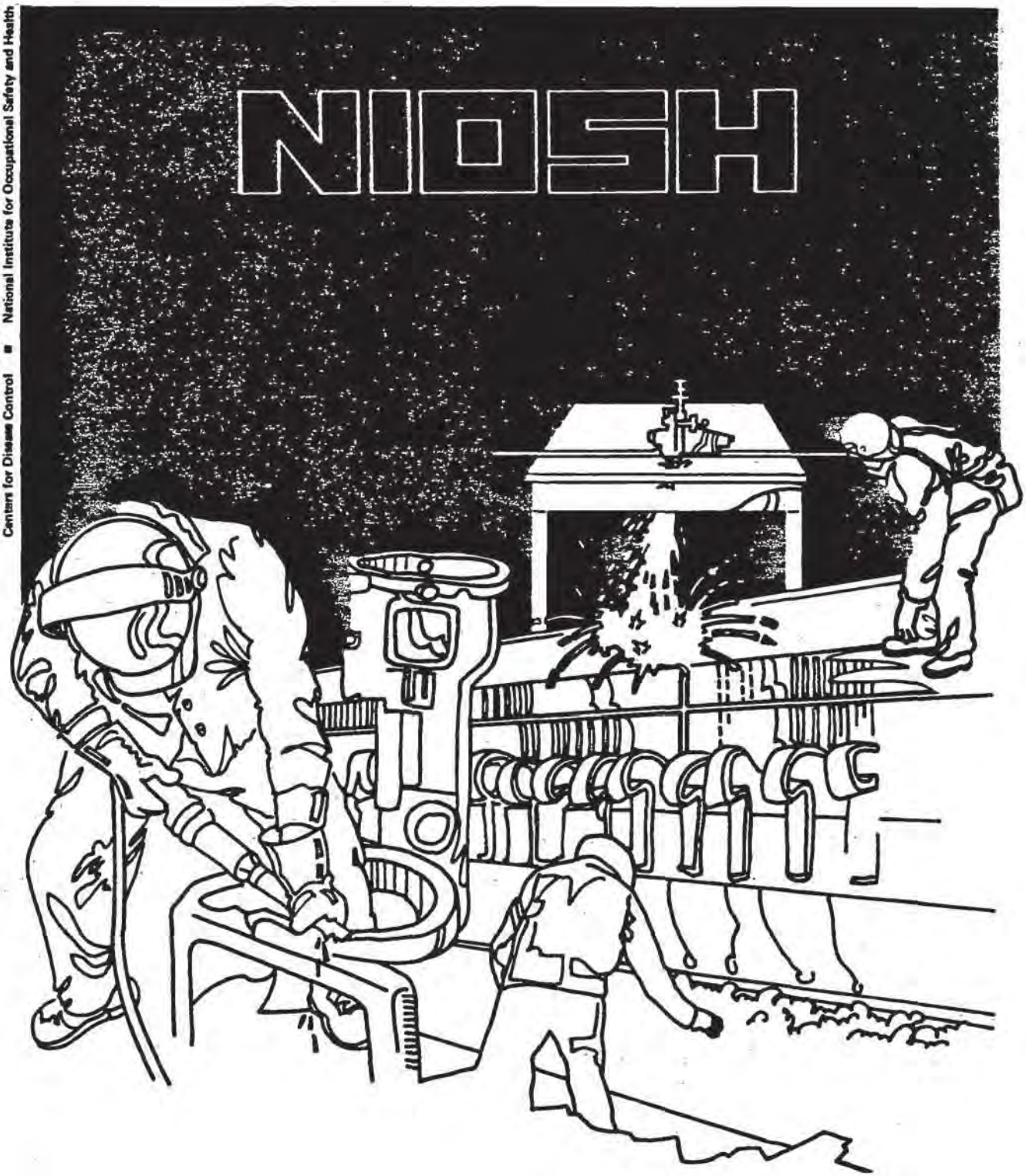

Health Hazard Evaluation Report

HETA 82-113-1374
MAINSTREET ENTERPRISES
LEBANON, INDIANA

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 82-113-1374
SEPTEMBER 1983
MAINSTREET ENTERPRISES
LEBANON, INDIANA

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I. SUMMARY

In January 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate the occurrence of cases of benign breast tumors among female staff members exposed to concrete dust at Mainstreet Enterprises, Lebanon, Indiana. The facility is a rehabilitation sheltered workshop where handicapped rehabilitees on occupational therapy are supervised by staff members. The only activity involving the use of any chemicals at this workshop is in the formulation and packing of a concrete mortar compound.

On February 25, 1982, and on March 9, 1983, NIOSH conducted surveys at the facility. NIOSH interviewed all current staff supervisors, and examined available records of staff members and rehabilitees who have worked at this facility since it opened in 1971. All five current female staff supervisors were seen by the same physician and diagnosed as having benign breast tumors during a one-year period from July 1981 to June 1982. The median interval between starting employment at Mainstreet Enterprises and the diagnosis of benign breast tumors was five months. Thirty-three female staff supervisors have been employed for varying periods since the facility opened. There was no significant difference in the prevalence of benign breast tumors in those supervisors who worked on the concrete powder (Fix-Crete) process (3 of 6) compared to those who did not (6 of 27). Twenty-six female rehabilitees have been registered at the facility since its opening. There was no significant difference in occurrence of benign breast tumors in rehabilitees who worked on Fix-Crete (2 of 12) compared to those who did not (3 of 14).

Bulk sample analysis of the Fix-Crete compound revealed total chromium and silica at less than the analytical limit of detection, no detectable asbestos, and hexavalent chromium at 32 micrograms per gram of bulk material.

Personal breathing zone and area air samples were collected for measurement of exposure to respirable and total particulates and hexavalent chromium. Analysis of the environmental air samples produced the following ranges of concentrations, which are compared with their respective environmental criteria (EC): respirable particulates 0.5 - 2.3 mg/m^3 (EC - 5.0 mg/m^3 less than 1% quartz); total particulates 1.7 - 34.3 mg/m^3 (EC - 10 mg/m^3). No detectable airborne hexavalent chromium was found.

On the basis of the data obtained during this investigation, NIOSH has determined that there was no evidence linking the occurrence of cases of benign breast tumors to exposure to chemicals used in the concrete powder manufacturing process. However, overexposure to dust generated during the process was documented for one task. Measures to reduce exposures to the dust are recommended in Section IX of this report.

KEYWORDS: SIC 3273 (Ready-Mixed Concrete), 3241 (Portland Cement), 8331 (Sheltered Workshops), total nuisance dust, respirable dust, fibrocystic breast disease, breast tumors.

II. INTRODUCTION

In January 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the executive director of Mainstreet Enterprises, Lebanon, Indiana, to evaluate the occurrence of a number of cases of benign breast tumors among female staff members with some exposure to concrete dust. The dust is generated in the process of packaging a dry powdered concrete mortar mix (Fix-Crete).

NIOSH investigators conducted an initial survey at the facility on February 25, 1982, and a follow-up evaluation on March 9, 1983.

III. BACKGROUND

Mainstreet Enterprises is a non-profit rehabilitation sheltered workshop and is part of Disabilities Services, Inc. serving Boone, Montgomery, and Clinton counties in Indiana. It began operations in 1971, and its main function is the occupational rehabilitation of physically and mentally handicapped individuals. These rehabilitees are usually referred from State hospitals or the Department of Mental Health. Seven supervisory staff members are currently employed to oversee their activities. These activities include the production and packaging of Fix-Crete from several ingredients including Portland cement, iron powder, gypsum, sodium and ammonium chloride, and a detergent. A mechanical hopper is used to mix these powdered ingredients, and up to a dozen rehabilitees may be involved in the process. The staff members take turns supervising this particular activity. The Fix-Crete process is the only one in the facility where chemicals are handled. The process was started on a small scale in 1971. After November 1976, when Mainstreet Enterprises moved to its present location, production of Fix-Crete was increased. A maximum of just over 3000 pounds of Fix-Crete may be produced in several batches in any workday. Some 30 other rehabilitees work in a separate area sorting and packing books, fitting metal components, and doing other light assembly work. This work does not involve any direct exposure to or contact with chemicals.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

On the initial survey, bulk samples of the finished Fix-Crete compound were collected for analysis of asbestos, crystalline silica, hexavalent chromium, and total chromium content. Personal breathing zone and area air samples were collected for measurement of exposure to hexavalent chromium, respirable dust, and total dust. The sampling and analytical methodology for these substances including collection device, flow rate, and referenced analytical procedures are presented in Table I.

Personal breathing zone and area air sampling was also conducted on the follow-up survey, with the intent of taking a separate set of air samples in the morning, making some minor ventilation adjustments (decreasing hood entry size) during the lunch break, and then taking a duplicate separate set of air samples in the afternoon to determine the effectiveness of the ventilation modifications.
Respirable and total particulate air samples were collected, and ventilation measurements were made at the material loading port/exhaust hood for the Fix-Crete mixer/hopper using smoke tubes and a Kurz ® velometer.

B. Medical

All seven current supervisors were interviewed. An attempt was made to obtain a list of all supervisors and rehabilitees who have worked in Mainstreet Enterprises since it opened. Available medical records were checked for any evidence of breast disease.

V. EVALUATION CRITERIA

Environmental Criteria and Toxicological Effects

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 solely 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 only 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.

A. Portland Cement

This is a class of hydraulic cements consisting mainly of tricalcium and dicalcium silicate with varying amounts of alumina, tricalcium aluminate, and iron oxide.[1] The crystalline silica content is usually less than 1%. Portland cement is an odorless, gray powder which can cause irritation of the eyes, nose, and respiratory tract. It can also cause a primary irritant dermatitis due to its alkaline, hygroscopic, and abrasive properties. An allergic dermatitis can also develop due to the chromium content.[2] Some hexavalent chromium compounds, especially those of low solubility, are suspected carcinogens.[3] The current OSHA standard for Portland cement is an 8-hour TWA of 50 million particles per cubic foot of air (mppcf) [or 15 milligrams per cubic meter of air (mg/m^3)][4]. ACGIH[5] recommends a 30 mppcf (10 mg/m^3) TLV for Portland cement. Both the OSHA standard and the ACGIH TLV apply to Portland cement containing less than 1% quartz.

B. Chromium

Chromium compounds can cause an allergic dermatitis in some workers. Acute exposure to chromium dust and mist may cause irritation of the eyes, nose, and throat. Chromium exists as chromates in one of three valence states: 2+, 3+, and 6+. Chromium compounds in the 3+ state are of a low order of toxicity. In the 6+ state, chromium compounds are irritants and corrosive. This hexavalent form may be carcinogenic or non-carcinogenic, depending on solubility. The less-soluble forms are carcinogenic.

Workers in the chromate-producing industry have been reported to have an increased risk of lung cancer (Bidstrup and Case, 1956).[6] ACGIH has adopted an 8-hour TCV of 0.5 mg/m^3, for chromium (3+) compounds,[5] whereas the OSHA standard for chromium metal and insoluble salts is 1.0 mg/m^3,[4]. NIOSH's recommended standard for carcinogenic chromium (6+) compounds is 0.001 mg/m^3. NIOSH also recommends a standard of 0.025 mg/m^3 for non-carcinogenic hexavalent chromium compounds, along with a 15-minute ceiling level of 0.05 mg/m^3.[7]

C. Particulates and Respirable Dusts

In contrast to fibrogenic dusts which, when inhaled in excessive amounts, cause scar tissue to be formed in the lungs, so-called "nuisance" dusts are stated to have little adverse effect on lungs and do not produce significant organic disease or toxic effects when exposures are kept under reasonable control. The "nuisance" dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lung when inhaled in sufficient amount. However, the lung tissue reaction caused by inhalation of "nuisance dusts" has the following characteristics: 1) the architecture of the air spaces remains intact; 2) collagen (scar tissue) is not formed to a significant extent; and 3) the tissue reaction is potentially reversible.

Excessive concentrations of dusts in the workroom air may seriously reduce visibility, may cause irritation of the eyes, ears, and nasal passages or cause injury to the skin or mucous membranes by chemical or mechanical action per se or by the rigorous skin cleansing procedures necessary for their removal.[5]

Respirable dusts, called such due to their size characteristics and ability to be inhaled, include particulates with more restrictive size range parameters than total nuisance dusts. In general, particulates between 5 and about 0.5 microns in size are deposited in the alveoli and respiratory bronchioles and some types of dust of such sizes can cause pulmonary fibrosis. Most of the particles five microns and larger are collected in the upper respiratory passages. Like nuisance dusts, the overall effects of respirable particulates are dependent on their site of deposition and on their toxic and antigenic properties.[1]

OSHA's standard for inert or nuisance dusts (less than 1% crystalline silica) is 50 mppcf (15 mg/m^3) and 15 mppcf (5 mg/m^3) for respirable dusts.[4] ACGIH has a TLV of 30 mppcf (10 mg/m^3) for total dust (less than 1% quartz) and 5 mg/m^3 for respirable dusts.[5]

VII. RESULTS

A. Environmental

Bulk sample analysis of the finished Fix-Crete compound collected on the initial NIOSH survey, February 25, 1982, revealed hexavalent chromium at 32 micrograms (ug) per gram of bulk material. This is not unusual since Portland cement is known to contain hexavalent chromium. Total chromium and silica were at less than the laboratory analytical limit of detection and no detectable asbestos was found in the bulk of Fix-Crete. When hexavalent chromium is detected, one can naturally assume total chromium to be present. The reason for the unexpected non-detectable total chromium and detectable hexavalent chromium was that the laboratory analytical limit of detection for chromium +6 is much lower and more sensitive than that for total chromium.

Results of the environmental air samples obtained on the initial NIOSH survey are presented in Table II. Personal breathing zone and stationary area air samples were taken for assessment of staff and client exposures during Fix-Crete manufacturing processes. Respirable particulate concentrations ranged from 0.8 mg/m^3 to 2.3 mg/m^3. These are below the ACGIH TLV and OSHA standard of 5.0 mg/m^3. Total particulate concentrations ranged from 2.9 mg/m^3 - 34.3 mg/m^3. Of the three samples for total particulates (two personal and one area), one had a concentration significantly above the ACGIH criterion of 10 mg/m^3 and the OSHA standard of 15 mg/m^3, one was just in excess of the ACGIH recommended level at 10.3 mg/m^3, and one was well below the OSHA standard and ACGIH TLV. No airborne hexavalent chromium was found in the one sample (analytical limit of detection [0.2 ug]).

The findings of the air samples collected on the follow-up survey, March 9, 1983, are presented in Table III. Personal breathing zone and area air samples were obtained for respirable particulates and showed concentrations of 0.5 mg/m^3 and 1.1 mg/m^3 respectively, both well below the OSHA standard and ACGIH TLV of 5.0 mg/m^3. Total particulate concentrations ranged from 1.7 - 13.8 mg/m^3, with the highest concentration, 13.8 mg/m^3, in a personal sample, in excess of the ACGIH's TLV of 10 mg/m^3.

Air sampling was performed on the follow-up survey to characterize exposures to respirable and total particulates before and after making some minor ventilation modifications. This was done to determine the effectiveness of the ventilation adjustments. Specifically, the exhaust hood/materials entry part for the mixer/hopper was temporarily decreased in size using plastic sheeting. The initial thought was that by decreasing the available hood entry area one could expect an increase in the capture ventilation rate and dust collection efficiency near the hood and a

decrease in the airborne dust levels. Although the hood capture ventilation rate was increased by 53% (from 70 to 107 FPM), three of five sets of air samples indicated a higher dust concentration in the afternoon. This unexpected variation in sample results may be attributable to a 15- to 20-minute afternoon clean-up operation involving dry-sweeping.

The mixer/hopper equipment used in the Fix-Crete production process was not originally designed to handle such fine materials as Portland cement. Even though this concrete powder manufacturing equipment (installed in 1971) was retrofitted with a dust collection system in 1979, the ductwork is not airtight, and (possibly due to worn-out seals) dust readily leaks from various locations on the machinery including the small clean out portal at the bottom of the hopper. The material loading skip is dry swept after every batch of Fix-Crete to prevent component build up. The fill outlet at the hopper is about three feet off the floor. This arrangement requires the mixer to hold the plastic containers (capacities 2-1/2 to 50 pounds) up to the filling port to be loaded. Any excess material becomes airborne until it settles in the overflow container on the floor. Consequently, the use of this equipment for purposes other than those for which it had been designed has contributed to the mixer operator's excessive dust exposure.

B. Medical

There are seven supervisors working in the facility, five of whom are females. All five current female supervisors (2 of whom worked in the Fix Crete Process) have been examined by the same physician and diagnosed as having fibrocystic disease of the breast. Two had mild, two had moderate, and one had severe fibrocystic disease. The diagnosis was confirmed by mammograms done in July 1981 (1 person), January 1982 (3 persons), and June 1982 (1 person). Three of these supervisors have had surgical treatment.

The characteristics of the five female supervisors with benign breast disease are as follows:

Age	Median = 30 yrs.	Range = 19 - 38 yrs.
Race	5 white, 0 black	
No. of pregnancies	Median = 2	Range = 0 - 3
Age of menarche	Median = 13 yrs.	Range = 12 - 17 yrs
Family history of breast disease	3/5 (60%)	
Smoking history	2 smokers, 2 non-smokers, and 1 ex-smoker.	
Coffee consumption	2 regular coffee drinkers and 3 non coffee drinkers	
Length of time on oral contraceptive pill	Median = 1.5 yrs	Range = 0.5 - 5 yrs
Interval between beginning job as supervisor and diagnosis of fibrocystic disease of the breast	Median = 5 mths.	Range = 3 mths - 4.5 yrs.

The available records indicate that 41 supervisors (8 males and 33 females) have been employed for periods from 3 months to 6 years since the facility opened in 1971. Nine of the 33 females (27%) have had benign breast disease diagnosed during their employment. Three of six (50%) Fix-Crete process supervisors had benign breast disease, compared to six of 27 (22%) non Fix-Crete supervisors, a difference that is not statistically significant. (p=0.19, Fisher's exact test, 1-tailed).

Sixty-nine rehabilitees (43 males and 26 females) registered for rehabilitation at Mainstreet Enterprises since it began in 1971. Twenty-nine (17 males and 12 females) have worked on the Fix-Crete process. Five of the female and none of the male rehabilitees were known to have had breast disorders. One had fibroadenoma and the other 4 had fibrocystic disease. Again, the proportion of Fix-Crete workers with benign brease disease (two of 12) was not significantly different from non Fix-Crete workers (three of 14). (p=0.58, Fisher's exact test, one-tailed)

No complete records are available for those who have left employment. For such individuals who have had benign breast disease there is therefore no information on severity of disease, whether mammograms were done, or if surgical treatment was performed. For those who did not have benign breast disease during their employment at Mainstreet Enterprises, it was not possible to ascertain if they developed such disease subsequent to leaving.

VIII. DISCUSSION AND CONCLUSIONS

Benign breast disease is a term that has been used to include a variety of breast disorders that are clearly not carcinoma. The spectrum of such disorders ranges from benign neoplasms, including intraductal papilloma and fibroadenoma, to cysts and galactocoeles and fibrocystic disease of the breast. The concern in this evaluation centers primarily around fibrocystic disease of the breast, also termed mammary dysplasia, chronic cystic mastitis, cystic hyperplasia, and fibroadenosis.[8] The underlying pathological mechanism for this condition is believed to be an exaggeration and distortion of the cyclic breast changes that normally occur through the menstrual cycle.[9] Predisposition to carcinoma is a controversial issue and studies have produced divergent findings on this relationship.[9]

Fibrocystic disease of the breast is the single most common disorder of the breast and accounts for over one-half of all surgical operations on the female breast. Estimates of the prevalence varies depending on different diagnostic criteria used. In 225 autopsies of patients with no previous benign or malignant disease Frantz et al[10] found chronic cystic disease in 28%. They also noted that chronic cystic disease with significant epithelial proliferation occurred in 14%. Haagensen[11] estimated that at least 10% of all women will develop clinically apparent cystic disease. Love et al[12] refers to the occurrence of fibrocystic disease by clinical diagnosis in 50% of

females, and by histological diagnosis in 90% of females. The extent and degree of diagnosis would depend in part on how much the examining physician makes use of the patient's medical history and physical examination alone, or if mammograms and biopsy are also done.

Over a one-year period at Mainstreet Enterprises all five current female supervisors were clinically diagnosed as having fibrocystic disease. They were seen by the same physician and mammography was used as an aid to diagnosis in all five cases. It is inappropriate to attempt to compare the prevalence at this facility with the values from studies referred to earlier. This is because the diagnostic criteria and approach are different and the number of women involved at Mainstreet Enterprises is small. Among all female supervisors who have worked at the facility since it opened in 1971, the prevalence of fibrocystic disease diagnosed during the term of employment is 27%. If all female supervisors and rehabilitees who have worked at Mainstreet Enterprises are considered, the prevalence of fibrocystic disease diagnosed during the term of employment is 22%. However, these figures do not take into account employees or rehabilitees who may have developed fibrocystic disease after they left Mainstreet Enterprises since such data were not available.

We found no published epidemiologic or animal studies linking any of the ingredients used in Fix-Crete to the development of benign or malignant breast disease. Hexavalent chromium compounds, which are present in cement (one of the ingredients of Fix-Crete), are suspected carcinogens[3], but the target organs associated with these compounds have not included breast tissue.

In the five current female supervisors at Mainstreet Enterprises, the interval between initial employment at this facility and the diagnosis of fibrocystic disease of the breast ranges from 3 months to 4.5 years (median interval of five months). The short interval decreases the likelihood of an occupational etiology.

Several factors have been reviewed by Ernster VL[13] with regards their relevance to benign breast disease. This includes increase in age associated with an increase in fibrocystic disease of the breast, and use of oral contraceptives as a protective factor against biopsy-defined benign breast disease.[14]

Coffee consumption has been suggested as a possible factor in the etiology of fibrocystic disease.[15] This is thought to be an effect of methylxanthine.[16] However limitations of the original studies on this have been presented[17] and it appears that the association is not well established.

The group of five workers at Mainstreet Enterprises with fibrocystic disease of the breast showed no striking features in terms of these risk factors.

The only overexposure NIOSH documented was that of total nuisance particulates, and this was limited to the mixer operator. The ultimate reduction of overexposure to levels of known or potential health effects must be accomplished by the implementation of improved engineering controls of workplace contaminants such as automation, redesign or replacement of existing mechanical ventilation systems and/or process equipment, or a combination of these measures.

During the initial and/or follow-up survey deficiencies in work practices and process controls were recognized. Some rehabilitees who wore gloves periodically clapped their hands to rid them of excessive dust. Manual crunching/shaking of empty cement bags occurred occasionally. The respirators used by rehabilitees and staff in the Fix-Crete production process (with the exception of the 3M model 8710) do not have certification and approval by NIOSH. However, with the exception of the mixer operator, the rehabilitees and staff supervisors' exposures to nuisance particulates were not excessive. Hence their need for use of respirators is left to their own discretion.

IX. RECOMMENDATIONS

1. The mixer operator's exposure to particulates should be reduced through effective engineering controls. Engineering consultants should be retained by Mainstreet Enterprise management to further evaluate the Fix-Crete production process with a goal of minimizing exposures to the mixer operator so as to eventually eliminate the need for respiratory protection.

   The attempt by NIOSH investigators to control dust levels: installation of temporary plastic sheeting on the exhaust hood/materials entry port for mixer/hopper to decrease the hood entry size and increase the capture ventilation rate seems reasonable, however, other means to control dust levels/exposures should be solicited from the engineering consultants.

2. Periodically ascertain that the local exhaust ventilation system provided for the mixer/hopper is air tight so that dust particulates do not escape from gaps in the duct work.

3. Respirators (for the mixer operator: approved and certified by NIOSH) as a means of control should be used while effective engineering controls are being implemented. In addition, Mainstreet management should construct and enforce a respiratory program consistent with the guidelines found in DHEW (NIOSH) Publication No. 76-189, "A Guide to Industrial Respiratory Protection," and to the General Industry Occupational Safety and Health Standards (29 CFR 1910.134).

4. Provide vacuum cleaning equipment in the Fix-Crete manufacturing area for use in collecting particulate debris from the clothing of staff personnel and rehabilitees instead of dispersing particulates by using compressed air. Vacuum floor and work benches instead of dry sweeping to help in keeping airborne dusts to a minimum.

5. Provide a vertically adjustable work surface at the material filling outlet on the Fix-Crete production equipment to (a) help alleviate/strain of manually holding the containers up to the fill outlet, and b) reduce the potential for excess Fix-Crete compound to become airborne.

6. As mentioned earlier Portland cement can cause a primary irritant dermatitis due to its alkaline, hygroscopic, and abrasive properties. Also, an allergic dermatitis can develop due to the hexavalent chromium in Portland cement.[2] Prolonged direct skin contact with Portland cement and Fix-Crete compound should be avoided by use of protective gloves. Cleaning/washing facilities should be available and used for all personnel working in and around the Fix-Crete production area. Rehabilitees who are physically or mentally handicapped may need supervision regarding the use of such facilities.

X. REFERENCES

1. National Institute for Occupational Safety and Health. Occupational diseases: a guide to their recognition. Revised ed. Cincinnati, Ohio: NIOSH 1977 (DHEW [NIOSH] Publication no. 77-181).

2. Proctor NH, Hughes JP. Chemical hazards of the workplace. Philadelphia: J.B. Lippincott Company, 1978.

3. National Institute for Occupational Safety and Health. NIOSH/OSHA occupational health guidelines for chemical hazards. Cincinnati, Ohio: NIOSH, 1981. (DHHS [NIOSH] publication no. 81-123).

4. Occupational Safety and Health Administration. OSHA Safety and Health Standards, 29CFR 1910.1000. Occupational SAfety and Health Administration, revised 1980.

5. American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Change for 1982. Cincinnati, Ohio: ACGIH, 1982.

6. Bidstrup PL, Case RAM. Carcinoma of the Lung in Workers in the Bichromate-producing Industry in Great Britain. Brit J. Ind. Med. 1956, 13:260.

7. National Institute for Occupational Safety and Health. Criteria for a recommended standard: occupational exposure to chromium VI. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1976. (DHEW Publication No. (NIOSH) 76-129).

8. Schwartz et al. Principles of Surgery 2nd. Ed. 1974. McGraw-Hill Book Co. New York.

9. Robbins SL and Cotran RS. Pathologic Basis of Disease 2nd Ed. 1979. WB Saunders Co. Philadelphia.

10. Frantz VK, Pickren JW, Melcher GW, et al Incidence of chronic cystic disease in so-called "normal breasts" Cancer 1951;4:762-83.

11. Haagensen CD Diseases of the breast. 2nd ed. Philadelphia: Saunders, 1971.

12. Love SM, Gelman RS, Silen W. Fibrocystic "disease" of the breast - a nondisease? N. Engl. J. Med. 1982;307(16):1010-1014.

13. Ernster VL. The Epidemiology of Benign Breast Disease. Epidemiologic Reviews. 1981. 3:184-202.

14. Ory H, Cole P, MacMahon B, et al. Oral contraceptives and reduced risk of benign breast diseases. N. Engl. J. Med. 1976;294:419-22.

15. Minton JP et al. Caffiene, cyclic nucleotides, and breast disease. Surgery 1979, 86(1):105-109.

16. Minton JP et al. Clinical and biochemical studies on methylxanthine-related fibrocystic breast disease. Surgery 1981, 90(2):299-304.

17. Heyden S. Coffee and fibrocystic breast disease. Surgery 1980, 88(5):741-742.

18. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods; Vol. 1, Publication No. 77-157A, 1977; Vol. 5, Publication No. 79-141, 1979. Vol. 6, Publication No. 80-125, 1980.

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Mainstreet Enterprises: Lebanon, Indiana
2. NIOSH, Region V
3. OSHA, Region V
4. IOSHA (State): Indianapolis, Indiana

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 I

Sampling and Analysis Methodology

Mainstreet Enterprises
Lebanon, Indiana
HETA 82-113

Substance	Collection Device	Flow Rate (liters per minute)	Analysis	References[18]
Asbestos	Bulk Sample Vial	-	Polarized Light Microscopy	-
Hexavalent Chromium	Bulk Sample Vial & Tared PVC Filters	- 1.5	Colorimetric	P&CAM 319 P&CAM 319
Total Chromium	AA-MCEF Filter	1.5	Atomic Absorption Spectroscopy	P&CAM 152 with Modifications
Respirable Particulates	Tared PVC Filter	1.7	Gravimetric	-
Total Nuisance Particulates	Tared PVC Filter	1.5	Gravimetric	-
Crystalline Silica	Bulk Sample Vial	-	X-ray Diffraction	P&CAM 259 with Modifications

TABLE II

Results of Environmental Air Samples, For Respirable and Total Nuisance Particulates and Chromium VI

Mainstreet Enterprises
Lebanon, Indiana
HETA 82-113

February 25, 1982

Sample Location	Sample Time	Sample Volume (liters)	Respirable Particulates (mg/m^3)	Total Nuisance Particulates (mg/m^3)	Chromium VI (mg/m^3)
Area Sample Attached to hopper elevator above local exhaust vent hood	12:47-15:00	200	-	-	N.D.[3]
Area Sample Attached to hopper on N.W. corner	12:57-15:04	191	-	10.3	-
Personal Sample Supervisor: Fix-Crete Process	12:43-14:47	186	-	2.9	-
Personal Sample Mixer	12:16-14:47	212	-	34.3[2]	-
Personal Sample Packer	12:39-14:44	213	0.8	-	-
Personal Sample Weigher	12:31-14:42	223	2.3	-	-
Evaluation Criteria (time-weighted average, normal workday, 40 hour/week)			5	10	
Laboratory analytical limit of detection in mg/sample =			-	-	0.002

1. mg/m^3 - milligrams per cubic meter of air
2. Value given should be regarded as a minimum due to evidence of leakage of particulates around the filter and onto the backup pad
3. N.D. - nondetectable value

TABLE II

Results of Environmental Air Samples For Respirable and Total Nuisance Particulates

Mainstreet Enterprises
Lebanon, Indiana
HETA 82-113

March 9, 1983

Sample Location	Sample Time	Sample Volume (liters)	Respirable Particulates (mg/m^3)	Total Nuisance Particulates (mg/m^3)	Time-Weighted Average Concentration (mg/m^3)
Personal Sample Mixer	09:39-11:28	185	1.6	-	1.1
Personal Sample Mixer	12:00-14:45	281	0.7	-	
Personal Sample Mixer	09:40-11:25	158	-	9.5	13.8
Personal Sample	12:00-14:45	248	-	16.6	
Area Sample B.Z., height 2' from hood entry	10:10-11:30	120	-	1.7	1.7
Area Sample B.Z., height 2' from hood entry	12:09-14:48	239	-	1.7	
Area Sample B.Z., height 2' from hood entry	10:10-11:30	136	0.04	-	0.5
Area Sample B.Z., height 2' from hood entry	12:09-14:48	270	0.7	-	
Personal Sample Supervisor: Fix Crete Process	09:35-11:24	164	-	4.3	4.9
Personal Sample Supervisor: Fix Crete Process	12:00-14:17	206	-	5.4	
Evaluation Criteria (time-weighted average, normal workday, 40 hour/week)			5	10	

mg/m^3 = milligrams per cubic meter of air

DEPARTMENT OF HEALTH AND HUMAN SERVICES
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