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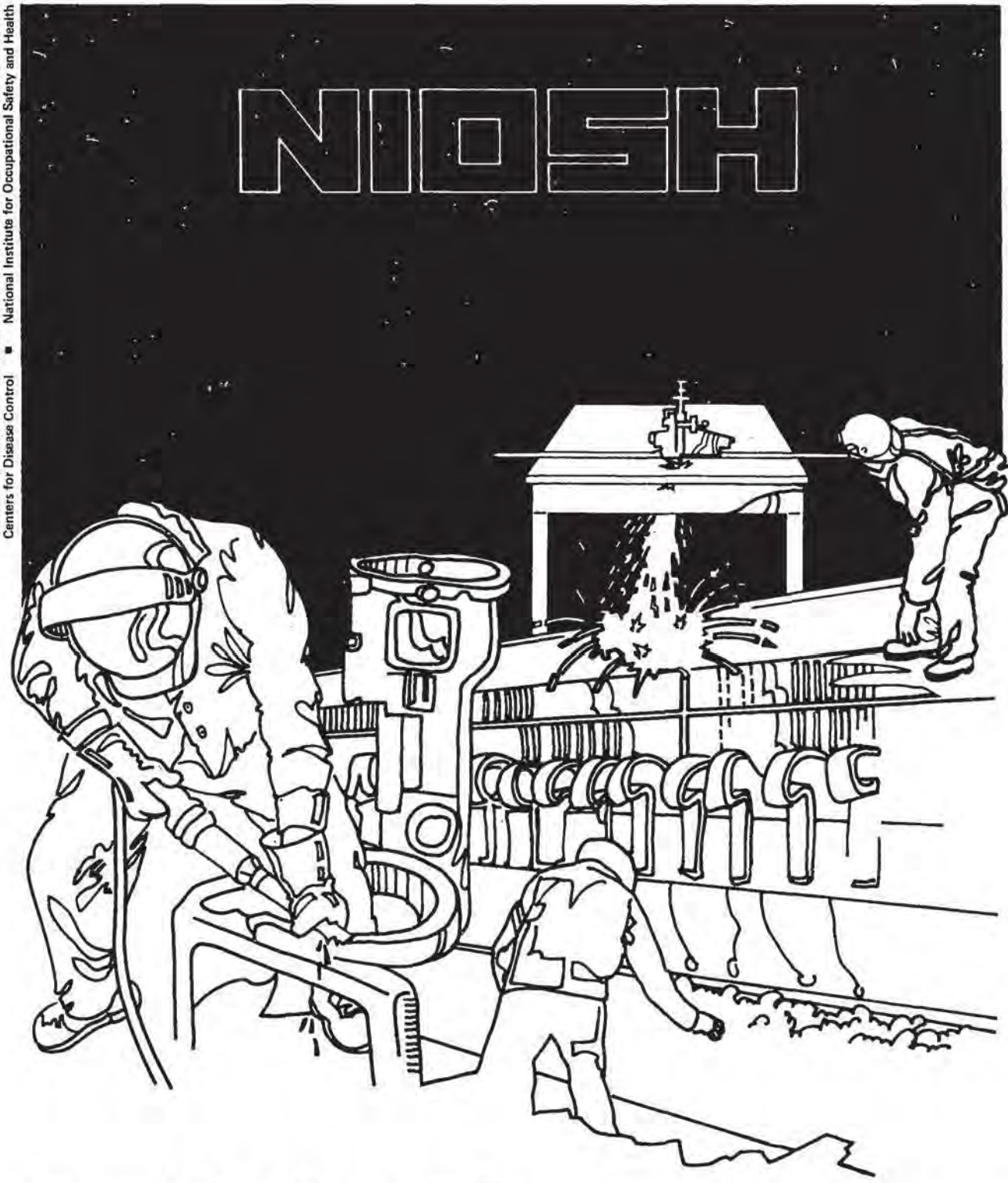

Health Hazard Evaluation Report

HHE 80-244-992
STAUFFER CHEMICAL COMPANY
CHICAGO HEIGHTS, ILLINOIS

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.

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Stauffer Chemical Company
Chicago Heights, Illinois

NIOSH INVESTIGATORS:
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I. SUMMARY

In September 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Oil, Chemical and Atomic Workers, Local 7765, for a health hazard evaluation at the Stauffer Chemical Company, Chicago Heights, Illinois. The requestor was concerned about possible health hazards, including cancer, resulting from exposure to diatomaceous earth in the Division 1 - Catalyst Section of the plant.

NIOSH investigators conducted an initial survey visit in September 1980. Environmental surveys were conducted in October 1980 and May 1981 during which personal area and bulk samples were collected to assess employee exposure to respirable crystalline silica, respirable diatomaceous earth, and phosphoric acid. In addition, confidential interviews were conducted with 6 employees in the area of concern.

Laboratory analysis of a rafter sample revealed that the workroom dust contained 3.7% quartz. In personal samples, the amounts of respirable crystalline silica (quartz and cristobalite) were below the NIOSH lower limit of quantitation, indicating no measurable employee exposure. Exposures to diatomaceous earth were below the Threshold Limit Value (TLV) of 1.5 mg of respirable dust per cubic meter of air (m^3) proposed by the American Conference of Governmental Industrial Hygienists. Time Weighted Average (TWA) values obtained from personal samples ranged from 0.29 mg/m^3 to 0.91 mg/m^3, with a mean of 0.63 mg/m^3. Exposures to phosphoric acid were below the Occupational Safety and Health Administration (OSHA) standard of 1 mg/m^3 on a 8-hour TWA basis. TWA values for personal samples ranged from 0.37 to 0.43 mg/m^3, with a mean value of 0.39 mg/m^3.

Employee interviews revealed no significant symptomatology related to environmental exposures. A review of current toxicological literature indicated no evidence that workers should experience an increased risk of cancer due to exposures at this process.

On the basis of data obtained during this investigation, NIOSH has determined that no hazard existed from employee exposure to crystalline silica, diatomaceous earth, or phosphoric acid at the time of this survey. To alleviate the potential for future health hazards, recommendations for maintaining local exhaust ventilation systems are included in Section VIII of this report.

KEY WORDS: SIC 2819 (Manufacturing - Industrial Inorganic Chemicals), crystalline silica, diatomaceous earth, Celite Filter-Cel, phosphoric acid.

II. INTRODUCTION

On September 8, 1980, an authorized representative of the Oil, Chemical and Atomic Workers Union, Local 7765, requested a NIOSH health hazard evaluation to determine if a hazard existed from the use of Celite Filter-Cel in Building 19, of the Division 1 - Catalyst Section of the Stauffer Chemical Company, Chicago Heights, Illinois. The request alleged that dust collection systems were not operating properly and that Celite was present in the air at all times. A concern was expressed that this substance might possibly form a cancer causing agent when heated. Since the operation was scheduled to be shutdown for modifications on October 10, 1980, the requestor was interested in an assessment of the current environmental exposures in the area.

NIOSH investigators responded to the request by conducting an initial survey visit on September 24, 1980. An opening conference was held with representatives of management and the union, followed by a walk-through survey and confidential interviews with employees in the catalyst building. Company officials indicated that the operation would be temporarily discontinued within 30 days for process modifications. In order to evaluate the conditions before the process shutdown, initial environmental surveys were conducted on October 3 and 9, 1980. An interim report was disseminated in December 1980. Preliminary findings indicated employee exposure to respirable crystalline silica and diatomaceous earth were below the environmental criteria (Refer to Section V). Phosphoric acid was detected in area samples at levels which indicated a need for further sampling to quantitate personal exposures. Subsequently, upon resumption of normal operations, a follow-up environmetal survey was conducted on May 7, 1981.

III. BACKGROUND

A. General Description of Plant Operations, Products, and Workforce

The plant is engaged in the production of various inorganic phosphate products. The specific area of the request, Catalyst Building 19, produces a silicon-phosphate catalyst which is used by the petroleum industry. Production has been carried out in this area for approximately 75 years. During normal activity, the process requires 5 production workers on each of 4 work shifts. Additionally, a mechanical maintenance person is employed on the day shift.

B. Process Description/Employee Duties

The raw materials for the catalyst are combined in a batch type operation. The mixer operator first dispenses a pre-determined amount of polyphosphoric acid into a mixing vessel resting on a scale. One and one-half fifty pound bags of Celite - Filter Cel are then hand charged into the mixing vessel containing the acid. The mixing vessel is then moved to the mixers by an overhead hoist. During mixing, an additional half-bag of Celite - Filter Cel is added through an opening in the top of the mixer. Next, the vessel is emptied into a large hopper where the polyphosphoric acid / Celite - Filter Cel mixture is dispensed onto a conveyor. This mixture then passes through one of five strainers and then one of the four extruders. One strainer and one extruder operator oversee this machinery. The mixture, now in the form of small pellets, is conveyed through a drying oven. Upon leaving the oven, the catalyst is dispensed into 55 gallons drums by the packaging operator. The drums are then capped and prepared for removal from the area.

The operator is responsible for overseeing the entire process. His duties include working at the various jobs to allow the other employees break time.

C. Personal Protection/Engineering Controls

The mixer operator is required to wear a full face shield when dispensing the acid. Full length clothing, gloves, hardhats, and safety glasses are required to be worn by all employees in the area.

Local exhaust ventilation was present at the scale, the mixers, the hopper, the strainers, the extruders, and the oven. During the initial survey, qualitative tests conducted with smoke tubes indicated that many of these systems were performing inadequately. A repeat of these tests after the process modifications indicated that all systems were functioning effectively.

IV. MATERIALS AND METHODS

A. Initial Environmental Surveys of October 3 and 9, 1980

Personal samples were collected near the workers breathing zone to assess employee exposures to respirable silica and respirable dust. Since the dust generated during this process resulted almost exclusively from the Celite - Filter Cel, the respirable dust samples were used to reflect levels of respirable diatomaceous earth. Each sample was collected using a portable battery powered pump operating at 1.7 liters of air per minute (lpm) attached with tygon tubing to a two stage 10 millimeter (mm) nylon cyclone. FWSB filters (37mm low ashing polyvinyl chloride, with a 5.0 micron pore size) mounted in 37mm cassettes were used as the collection media. A high volume air sample of the general workroom air was collected using a pump operating at 9.0 lpm attached with tygon tubing to a 1/2 inch metal cyclone utilizing a FWSB filter as the collection medium. In addition, a "rafter" sample was collected above the mixers to provide quantitative and qualitative information on the components of the dust (the percent and form of the free silica). Information pertinent to sample collection is given in Table 1. The analytical methods are detailed in Appendix 1.

Area samples were collected to assess the levels of phosphoric acid present in the workroom environment. Each sampling train consisted of a portable battery powered pump operating at 1.5 lpm attached via tygon tubing to a AA membrane filter (mixed cellulose ester) mounted in a 25mm cassette. Information pertinent to sample collection is given in Table 2. The samples were analyzed for phosphoric acid using NIOSH Method No. P&CAM 216.[1]

B. Follow-up Environmental Survey of May 7, 1981

Area samples for phosphoric acid collected during the previous surveys had indicated levels approaching the environmental standard. Therefore, when plant operations resumed, samples were collected to determine personal exposures to phosphoric acid. These samples were collected and analyzed in accordance with the methods used for phosphoric acid during the previous surveys. Information pertinent to sample collection is given in Tables 2 and 3.

C. Medical Questionnaires

Personal interviews were conducted with 6 employees in the area. This included administration of a non-directed medical questionnaire designed to collect general information regarding employment, smoking, and medical histories. Additionally, a supplemental questionnaire was included which related specifically to respiratory problems.

V. ENVIRONMENTAL CRITERIA

A. Diatomaceous Earth

Diatomaceous earth usually contains as much as 88% amorphous (noncrystalline) silica, and usually less than 5% quartz (a form of crystalline silica). The TLV proposed by the American Conference of Governmental Industrial Hygienists for diatomaceous earth is 1.5 mg respirable dust/m^3.[2] The current OSHA standard for amorphous silica, including natural diatomaceous earth, is 20 million particles per cubic foot of air (Mppcf), based on impinger samples as counted by light field techniques.[3] These levels are believed to protect the worker from pnuemoconiosis caused by the accumulation of dust in the lung.

B. Crystaline Silica

The NIOSH recommended standard for occupational exposure to crystalline silica is not to exceed 50 ug of the respirable fraction per/cubic meter of air (m^3) for a 10 hour time weighted average (TWA).[4] The current federal standard (OSHA) for crystalline silica (respirable fraction) is 10 milligrams silica per cubic meter of air divided by the percent SiO_2 plus 2, on an 8-hour TWA basis.[3] The primary health effect from exposure to crystalline silica is a chronic lung disease known as silicosis.

C. Phosphoric Acid

The federal standard for exposure to phosphoric acid is 1 mg/m^3 on a 8-hour TWA basis.[3] This standard is below the concentration that causes throat irritation among unacclimated workers and well below that which is well tolerated by acclimated workers.[3]

VI. RESULTS

A. Environmental

Laboratory analysis of the "rafter" sample showed the dust to contain 3.7% quartz. In all personal samples collected, the amounts of respirable crystalline silica (quartz and cristobalite) were below the NIOSH lower limit of quantitation, estimated to be 0.03 mg or 1.5% for a two milligram sample, for both polymorphs of silica.

Exposure to diatomaceous earth (measured as respirable dust) was below the environmental criteria. TWA values obtained from personal samples ranged from 0.29 mg/m^3 to 0.91 mg/m^3, with a mean value of 0.63 mg/m^3. A complete listing of these results is given in Table 1.

Exposures to phosphoric acid were below the current OSHA standard. TWA values obtained from personal samples ranged from 0.37 to 0.43 mg/m^3, with a mean value of 0.39 mg/m^3. A complete listing of these results is given in Tables 2 and 3.

B. Medical

The results of the employee interviews showed no significant symptomatology related to the employee exposures. Based on this lack of symptomatology, along with the relatively short duration of employment for many of the employees, a more comprehensive medical study was not deemed necessary.

VII. DISCUSSION AND CONCLUSIONS

The results of the environmental samples indicate that employee exposure to respirable crystalline silica, respirable diatomaceous earth, and phosphoric acid were below the corresponding environmental criteria. Local exhaust ventilation which was found to be operating ineffectively at the time of the initial survey, was subsequently replaced or modified during the process shutdown which further reduced contaminant levels [e.g.: the concentration of phosphoric acid detected in area sampling during the initial environmental survey (0.99 mg/m^3 for the area above the hopper) decreased noticeably by the follow-up survey (0.35 mg/m^3 for the area above the hopper)].

The original concern with the carcinogenic potential of the materials being handled was based on summary information of NIOSH Health Hazard #77-2-404.[5] This study evaluated the medical effects to workers employed at a plant producing diatomaceous earth products for approximately fifty years. The exposures at this plant included diatomaceous earth, calcinated diatomaceous earth (containing both amorphous and crystalline silica), and asbestos. A mortality study was undertaken but the authors stated that the results must be considered with caution since the observed numbers of deaths for each specific cause were quite small. Despite this problem they found that "deaths due to diseases of the respiratory system and lung cancer were among those causes which showed significant excesses". They linked the incidence of pneumoconiosis with the exposure to calcinated diatomaceous earth and its high proportion of crystalline silica, and the incidence of lung cancer with the exposure to asbestos.

A review of the literature indicates little evidence to implicate silica itself as a carcinogen. However, crystalline silica in combination with a known carcinogen may increase the risk of cancer development through possible effects on the immune system.[6] To date, human and animal studies concerning this possible effect of silica have not been definitive, and studies are currently being conducted to further examine this question. In light of this information, along with the environmental data which indicates no significant employee exposure to crystalline silica at this facility, no increased risk of cancer development would be expected for the workers at this process.

VIII. RECOMMENDATIONS

Inspection of local exhaust ventilation systems should be conducted routinely, and upon instances of employee complaints, to assure that dust and acid levels remain within safe levels.

IX. REFERENCES

1. NIOSH Manual of Analytical Methods: Volume 1, National Institute for Occupational Safety and Health, DHEW, NIOSH Pub. No. 77-157A, 1977.

2. Documentation of the Threshold Limit Values for Substances in Workroom Air (With 1977 Supplement) American Conference of Governmental Industrial Hygienists, Third Edition, 1971.

3. General Industry Safety and Health Standards (29 CFR 1910), U. S. Department of Labor, Occupational Safety and Health Administration, (Revised January 1976).

4. Criteria for a Recommended Standard Occupational Exposure to Crystalline Silica, National Institute for Occupational Safety and Health, DHEW Pub No. 75-120, 1974.

5. Health Hazard Evaluation Determination: Johns-Manville Sales Corporation, Lompoc, California. National Institute for Occupational Safety and Health, DHEW, Report No. 77-2-404, 1977.

6. "Non-Fibrous Mineral Dusts and Malignant Tumors", Katsnelson, B.A., Mokronosova, K.A., Journal of Occupational Medicine, Volume 21, No.1, January 1979.

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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination 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 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. 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 the following:

A. Oil, Chemical and Atomic Workers, Local 7765

B. Stauffer Chemical Company

C. U.S. Department of Labor, OSHA - Region V

D. NIOSH Regional Offices/Divisions

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

TABLE 1
RESULTS OF PERSONAL SAMPLES FOR RESPIRABLE PARTICULATE

Job Title/ Location	Sample Date	Sample Volume (liters)	Sample Time (min.)	Particulate Concentration* (mg/m3)
Packager	10/3/80	717	422	0.33
Extruder	10/3/80	724	426	0.81
Strainer	10/3/80	731	430	0.81
Mixer	10/3/80	746	439	0.29
Operator	10/3/80	736	433	0.37
#2 Operator	10/3/80	734	432	0.42
Extruder	10/9/80	719	423	0.67
Mixer	10/9/80	719	423	0.71
Strainer	10/9/80	717	422	0.85
Dryer	10/9/80	714	420	0.52
#2 Operator	10/9/80	714	420	0.84
Operator	10/9/80	673	396	0.91
Area/mixer	10/8/80	3555	395	0.45

*Concentrations expressed as time weighted averages for the sampling time.
Average weight of blank filter was -0.09 mg

In all personal samples collected, the amounts of respirable crystalline silica (quartz and cristobalite) were below the NIOSH lower limit of quantitation estimated to be 0.03 mg or 1.5% for a two milligram sample for both polymorphs of silica.

TABLE 2
RESULTS OF AREA SAMPLES FOR PHOSPHORIC ACID

Sample Location	Sample Date	Sample Volume (liters)	Sample Time (min.)	Phosphoric Acid* (mg/m3)
Left side of scale	10/3/80	374	249	0.37
Above hopper	10/3/80	596	397	0.99
Left side of scale	10/9/80	514	343	0.15
Above hopper	05/7/81	654	436	0.35
Between Mixers	05/7/81	644	429	0.34

*Concentrations expressed as time weighted averages for the sampling time.
The limit of detection was 3 ug H_3PO_4 per filter.
Blank filter weight for samples collected 10/3/80 and 10/9/80 was below 3 ug.
Blank filter weight for samples collected 05/7/81 was 6 ug.

TABLE 3
RESULTS OF PERSONAL SAMPLES FOR PHOSPHORIC ACID
(Collected 5/7/81)

Employee Job Title	Sample Volume (liters)	Sample Time (min.)	Phosphoric Acid* (mg/m3)
Mixer	772	448	0.43
Mixer	662	441	0.41
Extruder	653	435	0.38
Strainer	657	438	0.37
Operator	627	418	0.37

*Concentrations expressed as time weighted averages for the sampling time.
The limit of detection was 3 ug H_3PO_4 per filter.
Blank filter weight was 0.6 ug.

APPENDIX I
ANALYTICAL PROCEDURES

A. Respirable Particulate

The particulate weights of the samples were determined by weighing the samples plus the filters on an electrobalance and subtracting the previously determined tare weights of the filters. The tare and gross weighings were done in duplicate.

The instrumental precision of weighings done at one sitting is 0.01 mg. Because of variable factors such as overloading, hygroscopicity of sample, humidity and the physical integrity of the filter itself, the actual precision can be considerably poorer and occasional slight net negative particulate weights are to be expected.

B. Crystalline Silica

NIOSH Method P&CAM 259[1] was used to analyze the samples for free silica with the following modifications: (1) Filters were dissolved in tetrahydrofuran rather than being ashed in a furnace. (2) Standards and samples were run concurrently and an external calibration curve was prepared from the integrated intensities rather than using the suggested normalization procedure.

The lower limit of quantitation is estimated to be 0.03 mg or 1.5% for a two milligram sample for both polymorphs of silica.

Appendix Reference

1. NIOSH Volume of Analytical Methods: Volume 1, National Institute for Occupational Safety and Health, DHEW, NIOSH Pub. No. 77-157A, 1977.

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