U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION REPORT 72-91-37
MOBIL OIL CORPORATION
AUGUSTA, KANSAS

APRIL 1973

I. SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposures to asbestos dust and to hot environments relevant to the company's requirement for insulators' wearing of special clothing (paper coveralls) while working with asbestos at the Mobil Oil Corporations's Refinery in Augusta, Kansas.

On December 11-13, 1972, two (2) NIOSH investigators conducted an observational and environmental survey of inside operations involving the cutting of material containing asbestos and the mixing of "Mud" or "Super 88"; and outside operations involving the installing of insulation and "Mud"; and very limited stripping of old insulation. Thirty (30) personal and general area samples for airborne concentrations of asbestos were collected during these operations. None of the asbestos dust levels measured exceeded the present U.S. Department of Labor Standard of 5.0 fibers/cc (8-hour time-weighted average--TWA) or the 2.0 fibers/cc-8-hour TWA limit which will be in effect in 1976; and 10.0 fibers/cc (ceiling concentration). The unit measurement for the asbestos standard is the number of fibers greater than 5 micrometers in length per cubic centimeter (cc) of air as promulated by the U.S. Department of Labor (Federal Register, Volume 37, §1910.93a, June 7, 1972). For inside operations in the insulators' tool building the asbestos counts of individual personal samples varied from 0.6 to 3.3 fibers/cc, and the asbestos counts of general area samples varied from 0.1 to 0.9 fibers/cc. For outside operations the asbestos counts of personal samples varied from 0.2 to 1.5 fibers/cc and general area samples varied from 0.0 to 0.9 fibers/cc. The estimated 8-hour time-weighted average for the workers ranged from 0.3 to 0.6 fibers/cc.

Interviews with the four (4) insulators did not elicit any symptoms which could be attributed to overexposure of employees to asbestos, and medical records did not show any employee having a condition which could be attributed to exposure of employees to asbestos. The insulators did indicate previous symptoms (e.g., exhaustion, etc.) which could be attributed to heat stress. There have been two (2) cases of overexposure to heat or heat prostration in September 1972. It is felt that the wearing of paper coveralls over their personal clothes does contribute somewhat to the problem of exposure of the four (4) employees to hot environments.

It is our determination that asbestos is not toxic at the concentrations used and found in the insulators' working operation. This is based upon the environmental concentrations of asbestos obtained at the time of this survey and upon the documentation in the literature supporting the standard. No specific evaluation was made concerning the exposure of employees to hot environments and the concern of special clothing (paper coveralls) contributing to heat problems (e.g., heat prostration, etc.) as the survey was conducted in the winter with no operations involving any significant exposure of employees to hot environments. In this regard, it is determined that the wearing of special clothing such as semiporous paper coveralls over personal clothing does contribute to the potential heat stress problem, and does not meet the intent of the rules and regulations concerning the wearing of "Special Clothing" as required when environmental levels of asbestos exceed the "Ceiling Value" of 10 fibers/cc. General recommendations consistent with the rules and regulations set forth by the U.S. Department of Labor and good industrial hygiene practices have been made to management to obviate any potential hazards from the exposure of the four (4) employees to asbestos and "hot environments".

Copies of the Summary Determination as well as the Full Report of the evaluation are available upon request from the Hazard Evaluation Services Branch, NIOSH, 508 U.S. Post Office Building, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies of both have been sent to:

a) Mobil Oil Corporation, Augusta, Kansas

b) Authorized Representative of Employees

c) U.S. Department of Labor - Region VII

For purposes of informing the "affected employees," the employer will promptly "post" the Summary Determination in a prominent place(s) near where the four (4) insulators work for a period of 30 calendar days.

II. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure of insulators to asbestos dust and the wearing of paper coveralls by the four (4) insulators and the special clothing contributing to heat exposure problems (e.g., heat prostration) with their exposure to hot environments at the Mobil Oil Corporation Refinery at Augusta, Kansas.

III. BACKGROUND HAZARD INFORMATION

A. Standards

Asbestos:

The Occupational Health Standard promulgated by the U.S. Department of Labor applicable to the particular substance of this evaluation is listed below. Permissible exposure to airborne concentrations of asbestos fibers (Federal Register, Volume 37, §1910.93a, June 7, 1972--copy included as an appendix to this report entitled, "Rules and Regulations") is outlined as follows:

(1)	Standard Effective July 7, 1972	....5.0 fibers/cc*
(2)	Standard To Go Into Effect July 1, 1976	....2.0 fibers/cc*
(3)	Ceiling Concentration Applicable At all Times	...10.0 fibers/cc**

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* 8-hour time weighted average airborne concentration of asbestos fibers longer than 5 micrometers in length per cubic centimeter (cc) of air.

** Airborne concentration of Asbestos fibers longer than 5 micrometers in length per cc of air not to be exceeded at any time as determined by a minimum sampling time of 15 minutes.

Hot Environments (Heat Stress):

There are no current Federal Standards for exposure of employees to hot environments. However, NIOSH recommendations for such standards are contained in HSM 72-10269 entitled, "Criteria for a Recommended Standard ....Occupational Exposure to Hot Environments", by NIOSH, Health Services and Mental Health Administration, U.S. Department of Health, Education, and Welfare. A copy of this referenced document is enclosed for informational purposes. In general, healthy adults performing continuous moderate work can easily tolerate a wet bulb globe temperature of 79°F without developing heat disorders such as heat fatigue or prostration.

B. Toxic Effects

Toxic Materials:

Asbestos: Prolonged inhalation of asbestos fibers may result in the production of a typical pulmonary fibrosis which may be accompanied by severe respiratory disability. If large quantities of the fibers are inhaled over an extended period of time, characteristically 10 to 20 years, tissue reaction progresses until a generalized diffuse fibrosis (known as asbestosis) becomes evident. This fibrosis is seen first in the lower lobes of the lungs but eventually, if exposure continues, appears in the other lobes as well. Respiratory insufficiency and cardiac failure may supervene. Additionally, there is increasing evidence that the frequency of bronchogenic cancer is greater among workers in certain asbestos industries than expected in the general male population as well as more evidence of an increased rate of occurrence of mesothelioma of the pleura or peritoneum. These asbestos associated neoplasms may occur without radiological evidence of asbestosis which means that prevention of even short-term high level exposures to asbestos may be extremely important.

Physical Agents:

Hot Environments (Heat Stress): The physical effects of excessive exposure to environment heat are determined to a large extent by factors other than actual temperature. Workload, rest periods, water and salt supplementation, clothing, general physical fitness and acclimatization are all extremely important in determining levels at which effects can be expected to become manifest. In general, well adults performing continuous moderate work can easily tolerate a Wet Bulb Globe Temperature of 79°F without developing heat disorders.

Heat fatigue is the mildest of the heat disorders and is characterized by decreased ability to concentrate, tiredness, and irritability. Heat prostration (heat collapse, exhaustion, or syncope) results in weakness,

dizziness, vertigo, nausea, blurred or dim vision and mild muscular cramps which may progress to a listless, apprehensive semi-comatose state. In severe cases unconsciousness may result due to complete circulatory collapse even though the body temperature remains normal. The prognosis is excellent and the condition is usually transient. Heat cramps are sudden, severe muscular cramps resulting from excessive physical exertion in high temperatures due to perspiration. This condition occurs mainly among unacclimated individuals performing extremely severe physical labor in very hot environments such as strokers, miners, firemen, etc. The most severe heat disorder is heat hyperpyrexia (heat stroke). In this condition a profound disturbance of the heat-regulating mechanism occurs following prolonged exposure to excessively high temperatures leading to high fever and collapse. Convulsions, coma and death are not infrequent despite prompt medical attention. This heat disorder is largely a problem of the elderly non-working age population and the severity of the syndrome is usually related to an already compromised physical state due to heart, kidney or other underlying diseases.

IV. HEALTH HAZARD EVALUATION

A. Intitial Visit - Observational Survey

A health hazard evaluation survey of insulation operations at the Mobil Oil Corporation Refinery Plant was made on December 11-13, 1972, by NIOSH representatives, Messrs. Raymond L. Hervin and Raymond Rivera. The functions of the National Institute for Occupational Safety and Health and its relation to Section 20(a)(6) of the Occupational Safety and Health Act of 1970 were explained to Mr. W. W. McMullen, Manager Employee Relations; Mr. S. Gillette, Chief of Safety; and Dr. J. J. Stanko, Regional Industrial Hygienist; who assisted in the completion of the National Surveillance Network Part I Questionnaire. Mr. Milo McNairy represented the union and employees during the initial walk-through survey. Separate exit interviews were held with a few members of management including Mr. R. S. Grieves, Refinery Manager; and a few members of the union including Mr. Milo McNairy to answer any questions which may have arisen due to our survey.

Description of Facility, Process, and Conditions of Use:

The Mobil Oil Corporation at Augusta, Kansas employs 287 people of whom 200 are directly involved in the production of light petroleum grade fuels, asphalt, and similar products. The normal day-to-day operations utilizing material containing asbestos involve a total of four (4) employees who are insulators. These workers wear respirators and disposable paper coveralls during operations which may involve airborne asbestos. Other employees (e.g., laborers) may replace one of the four

(4) insulation craftsmen when they are on vacation, sick, or other leave. There are three (3) long-term (5 or more years) regular insulators and one (1) interim insulator at the time of the survey. The insulators worked on day shift only and are responsible for the maintenance, repair, and upkeep of insulation throughout the plant on a day-to-day basis. Major operations involving the repair and/or installation of insulation is accomplished by contracting out to other companies. One or all of the four (4) insulators will oversee the major insulation operations of the other contractor to assure that the job is adequate.

The day-to-day insulation operations normally involve one (1) hour being spent each day in the Insulators' Tool Building of approximately 15 feet by 50 feet by 10 feet high. Half of the building is used for storage of new and waste insulation materials and the remainder is used for work with sheet metal and asbestos material. The cutting (hand tools only) of preformed asbestos material (thermobestos-containing less than ten (10) percent asbestos) is accomplished on a 4 feet by 4 feet table with 3 inch slot ventilation on the middle, back, and sides of the table. Mixing of "Super 88" and/or "Mud" is accomplished in a hood around 3 feet by 3 feet by 4 feet with the front open for mixing operations. The slot ventilation provides for an average velocity of 700 feet per minute; and the hood an average velocity of 300 feet per minute at 2 inches from the face. There is also a large vacuum system (55-gallon barrel with cyclone, elephant truck, etc.) used for cleanup operations. All three (3) operations (cutting and forming, mixing of "Mud", and cleanup) are exhausted through a Roto-clone Type W (American Air Filter Company, Inc.) Air Exhauster which provides for a water spray wash of the air prior to discharge. The water containing the asbestos is discharged into a French Drain with a 10 feet radius and 10 feet deep. The company has recently installed the ventilation system to be in conformance with the rules and regulations promulgated by the U.S. Department of Labor for use of asbestos in industry which recommends engineering out, wherever feasible, any problems where airborne asbestos may be a problem. The ventilation in the tool shed for cutting, mixing, and cleanup appears adequate for the operations normally conducted in the tool shed as observed during this survey.

Outdoor operations involving the insulators consists primarily of installing new insulation and taking off old insulation. Operations consist of placing the preformed (as bought by the company, but cut to length if necessary by the insulator) semi-circular halves around a pipe and wiring the halves together for a tight fit. The reverse operation is

accomplished for taking off of old insulation. These two (2) operations were predominant during the survey and did not appear to generate much dust. However, "Mud" or "Super 88" is used for insulation around elbows, and bends in the piping. This is a wet mixture which is applied by hand around the bend in the piping and allowed to dry. There should not be much of an airborne problem as it is in a wet form. However, in removing old, dried "Mud" (which contains asbestos and is not the newer "Super 88") from the pipe, the insulators may have to use tools (e.g., saw, hammer, etc.) which would present a problem concerning airborne asbestos. On two (2) occasions, the stripping of old "Mud" containing asbestos was observed and only lasted for approximately five (5) minutes on each occasion. Cleanup operations consisted of placing the old asbestos in plastic bags and sealed with storage in the tool shed until disposal in the city or commercial waste dump by burial.

In observing the operations discussed above, it is noted that signs or labels were not conspicuously in use during various operations and although may not be necessary, may be appropriate for some operations to be in compliance with the regulations. The company has engineered out certain problem areas (e.g., cutting in tool shed, etc.) and has gone to products which contain less asbestos than previous insulation products containing asbestos. For instance, the main insulation material used is called "Thermobestos." It contains up to ten (10) percent asbestos; the new "Super 88" or "Mud" contains no asbestos. In addition, there are written instructions to the four (4) insulators on the wearing of coveralls and approved respirators during operations where asbestos may be airborne such as stripping operations. Hence, it is felt that the company has taken appropriate steps to meet the intent of the rules and regulations as promulgated by the U.S. Department of Labor concerning asbestos, however, may not be in complete compliance with all of the regulations as contained in the appendix to this report.

B. Environmental Evaluation

1. Procedure and Methods

On December 12-13, 1972, an environmental survey was conducted to determine the environmental exposure of four (4) employees (insulators) to airborne asbestos during outside and inside operations involving insulating materials containing asbestos. The primary operations noted at the time of the survey were the outside installation of insulation, and secondary or limited operations involving the inside cutting (tool shed) of insulation and mixing of "Mud".

A total of 24 personal air samples and 6 general area samples were obtained and analyzed for asbestos during all hours of 2 day shifts. Personal and general area samples were collected with the same type of instruments and filter. MSA Model G battery-operated vacuum pumps were used to draw air through tygon tubing attached to an open-faced filter holder containing 37-millimeter Millipore type AA filters at a rate of 2 liters per minute. The filter holder was attached to the employees' collars for the personal air samples, and the general area samples were collected in specific locations in the working environment. Sampling times ranged from 2.5 to 219 minutes. All of the 30 air samples were analyzed by the Laboratory Services, NIOSH, Salt Lake City, Utah using the standard phase contrast illumination microscopy techniques.

2. Survey Results

Twenty-four (24) personal and six (6) general area samples were obtained during operations involving four (4) insulators while handling asbestos containing materials. None of the asbestos dust levels at all operations exceeded the present U.S. Department of Labor's standard of 5.0 fibers/cc (8-hour time-weighted average) and 10.0 fibers/cc (ceiling concentration). The unit of measurement for the asbestos standard is the number of fibers greater than 5 micrometers in length per cubic centimeter (cc) of air as promulgated by the U.S. Department of Labor (Federal Register, Volume 37, § 1910.93a, June 7, 1972). The asbestos counts of short-term individual personal samples varied from 0.6 to 3.3 fibers/cc with asbestos counts of general area samples varying from 0.1 to 0.9 fibers/cc for inside operations in the insulators' tool building. The asbestos counts of short-term individual personal samples varied from 0.2 to 1.5 fibers/cc, with general area samples varying from 0.0 to 0.9 fibers/cc for outside operations. It is noted that the present Federal asbestos standard of 5.0 fibers/cc will be lowered to 2.0 fibers/cc for an 8-hour time-weighted average in 1976. The estimated 8-hour time-weighted average for December 13, 1972, which one may obtain from the results of this survey, ranged from 0.3 to 0.6 fibers/cc. The Regional Industrial Hygienist for Mobil Oil Company has performed previous environmental studies of these operations and his results are essentially in agreement with those obtained during this survey. Also, the Regional Industrial Hygienist (Mobil) obtained personal and general air samples during this survey. The results of the air samples obtained and analyzed by NIOSH are presented in Tables I, II, and III, of this report.

An evaluation of the exposure of the four (4) insulators to "hot environments" was not accomplished during this survey as the survey was conducted in the winter with no operations involving any significant exposure of employees to hot environments.

C. Medical Evaluation

The Medical Unit consists of a well-equipped laboratory, doctor's office, x-ray room, treatment room, first-aid room, and a reception area for patients. The Medical Staff consists of a full-time registered nurse and two (2) part-time (average 9 hours total per week) physicians who are on call on a 24-hour basis. Review of OSHA Form 102 and discussion with some of the Medical Staff, Regional Industrial Hygienist, and the Employee Relations Manager of Mobil Oil Company did not show any respiratory conditions which could be attributed to the exposure of employees to asbestos. They were aware of the medical examination and other requirements in the rules and regulations (refer to appendix to this report) as promulgated by the U.S. Department of Labor.

The NIOSH employees questioned all four (4) insulators concerning their experiences with asbestos material with particular emphasis on outward signs and symptoms associated with lung ailments. None of the workers claimed that they were suffering any adverse effects from working with asbestos. One employee did express the fact that he suffered from shortness of breath, but he appeared to be a heavy smoker. Further questioning of the four (4) insulators revealed that they had heard of a total of three (3) employees and in particular one case, in which asbestos was suspected as the causitive agent for retirement or disability but it was rumor only and there was no agreement with the insulators that these were in fact actual cases. The names of the three (3) were given to the NIOSH investigators and further questioning of the Medical Staff and others revealed that the three (3) cases of disability or retirement did not relate to the exposure of the three (3) employees to asbestos. The insulators were informed of this fact and were satisfied that it was a valid conclusion. No further medical evaluation is felt necessary due to the lack of apparent signs and symptoms associated with lung ailments. The company does have pre-employment and periodic physical examination program which includes chest x-rays.

Medical records show that two (2) employees suffered from heat prostration in September 1972. Both were insulators and were apparently working in a hot environment as well as the day being hot and humid. Apparently the men did not get sufficient relief (e.g., cool area, workload, rest, etc.) from normal operations and resulted in two (2) separate cases of insulators with heat prostration. In this regard, a copy of "Criteria for a Recommended Standard....Occupational Exposure to Hot Environments" is enclosed for use as a guideline for exposure to hot environments. In discussing this matter with the four (4) insulators,

it was felt that working in a hot environment such as removing or installing insulation around a hot vessel, pipe, or tank on hot and humid days during the summer can be exhausting but normally has not presented a problem as serious as the two (2) cases of heat prostration which occurred in September 1972.

It is noted that the use of the paper suits in asbestos work was instituted by the company sometime in the summer of 1972 and does contribute to potential heat prostration problems. The NIOSH investigators examined the paper suit which was initially used by the insulators and found them to be a very hard-finished, almost water-tight non-porous type paper suit or coveralls which are worn over the employees' personal clothes. It is felt that the particular suit worn over personal clothes does contribute to a heat stress problem as it would insulate the body from the free exchange of heat via evaporation of sweat and other body functions. Since the incidents of heat prostration in September, the company has purchased and is now using a different and more water-porous paper suit which is still worn over the employees' clothes. The practice of wearing a complete set of clothes plus an outer paper coverall even though a porous coverall would still contribute to, although to a lesser extent than non-porous suits, to a heat stress problem. Of particular interest to the NIOSH investigators was the fact that the paper suits of all four (4) insulators were seriously ripped at various places (e.g., elbows, crotch, etc.) and are susceptible to holes due to normal work, heat or chemical action during the environmental survey. It is noted that the reason for special clothing such as coveralls, head and foot coverings as required by the rules and regulations (refer to appendix) of the U.S. Department of Labor is to preclude an employee's personal clothing from being contaminated with asbestos and the subsequent contamination in the home with exposure of the family and re-exposure of the employee. The use of paper clothing which is easily ripped or torn does not meet the intent of the "Special Clothing" section of the rules and regulations contained in the appendix. A more suitable alternate would be the complete change and separation of the employee's street clothes from his work clothes and the wearing of cloth coveralls only without the outside street clothes under the coveralls. This would meet the intent of the regulations where such special clothing is required such as when environmental levels exceed the "Ceiling" concentration of 10 fibers/cc.

It should be emphasized that in no case were any individual medical files requested or examined by the NIOSH investigators during the medical evaluation. OSHA Form 102 was reviewed and only general medical questions were asked during the medical evaluation and questions were limited to information concerning asbestos and hot environments.

D. Conclusions

It is our determination that asbestos is not potentially toxic at the concentrations used or found at the time of this evaluation in the insulators working operations. This is based upon the results of the environmental survey being lower than current and future standards for asbestos at the time of the survey and the lack of symptomatology which could be attributed to excessive exposures to asbestos. However, it is noted that concentrations may well be significantly different on other occasions such a major stripping and insulation operations which were not observed at the time of the survey. No environmental measurements were made concerning employees' exposure to heat stress, although two (2) cases of apparent heat prostration did occur in September 1972 and is further discussed in Section III.C., of this report.

It is felt that the management and the Regional Industrial Hygienist at the Mobil Oil Corporation are well aware of heat and safety requirements and have taken several steps, such as engineering out potential problems, and have, with few exceptions, met the intent of the Federal regulations and criteria. The company's efforts in the area of safety and industrial hygiene are good and the use of approved respirators and special clothing is encouraged concerning operations involving airborne asbestos. It is further noted that the company has recently used insulating material with little (e.g., thermobestos less than 10%) asbestos and where possible material containing no asbestos. The cooperation of both management and union during the survey is most appreciated by the NIOSH investigators.

V. RECOMMENDATIONS

In view of the findings discussed above and in other sections of this report, it is recommended that the provisions of the rules and regulations (appendix) as contained in the Federal Register (Volume 37, §1910.93a, October 18, 1972); and in the NIOSH publication entitled, "Criteria for a Recommended Standard....Occupational Exposure to Hot Environments", should be carefully followed by management. It is further recommended that cloth coveralls be provided the employees in order to obviate the necessity of wearing two (2) sets of outer clothing as currently required by management; and the fact that cloth coveralls are normally more porous than paper coveralls. The laundering of such contaminated clothes could be readily accomplished in-house at the tool shed or other available facilities by the purchase of a

household washer and dryer if not now available. The requirements for the use of outside laundering services are contained in the appendix if an alternate method is needed. The furnishing of cloth coveralls would also obviate the potential contamination of the employees' clothing as required by the rules and regulations contained in the appendix. The cost of cloth coveralls and in-house laundry of about 20 coveralls/week or 4 coveralls/day should be around or less than the cost of using 4 paper coveralls/day which are disposed as waste each day. The continued wearing of approved respiratory protection during operations where asbestos may be airborne is also encouraged and may be required under Part (c)(2)(iii) entitled, "Spraying, demolition, or removal" of Section 1910.93a Asbestos, as contained in the appendix to this report.

TABLE I

INDOOR CUTTING OPERATIONS

Personal Air Sample Results (unless otherwise noted) of Insulators at Mobile Oil Corporation Plant while cutting thermobestos material or mixing Mud or Super 48 - Breathing zone samples collected on December 12-13, 1972.

Sample No.	Liters Sampled	Occupation & Any Other Operations	Asbestos Count*
46	12	Insulator No. 1	3.1
27	136	Insulator No. 1	1.1
47	8	Insulator No. 2	2.0
48	14	Insulator No. 3	3.3
32	12	Insulator No. 4	2.2
49	46	Insulator No. 4	0.6
28	136	Insulator No. 4	1.2
33	40	Breathing Zone/General Area above Cutting Table during cutting	0.9
39	24	Same as Filter No. 33	0 0.2
30	412	Same as Filter No. 33 except little cutting done	0.1
5	292	Same as Filter No. 30	0.1
22	---	Blank .03 Fibers/field	
44	---	Blank .06 Fibers/field	

*Units of Measurement: fibers/cc--the number of fibers longer than 5 micrometers in length per cubic centimeter (cc) of air

TABLE II

OUTDOORS INSULATION OPERATIONS

Personal Air Sample Results (unless otherwise noted as general area samples) of Insulators at Mobile Oil Corporation Plant during the tearing down of old and installation of new insulation - Samples collected December 12-13, 1972.

Sample No.	Liters Sampled	Occupation & Any Other Operations	Asbestos Count*
36	46	Insulator No. 1	0.9
29	184	Insulator No. 1	0.3
9	232	Insulator No. 1	0.2
17	336	Insulator No. 1	0.3
45	382	Insulator No. 2	0.6
41	78	Insulator No. 2 (use of Mud or Super 48)	1.5
3	170	Insulator No. 2	0.9
14	228	Insulator No. 2	0.3
23	416	Insulator No. 2	0.5
50	398	Insulator No. 3	0.5
37	80	Insulator No. 3 (use of Mud or Super 48)	0.3
31	172	Insulator No. 3	1.1
26	224	Insulator No. 3	0.2
20	408	Insulator No. 3	0.2
35	186	Insulator No. 4	0.9
10	232	Insulator No. 4	0.7
25	438	Insulator No. 4	0.6
38	11	General Area during Stripping Operations	0.0
42	5	General Area during Stripping Operations	0.9

*Units of Measurement: fibers/cc--the number of fibers longer than 5 micrometers in length per cubic centimeter (cc) of air

TABLE III

ESTIMATED 8-HOUR TIME-WEIGHTED AVERAGE
OF INDIVIDUAL AIR SAMPLE RESULTS

Occupation	Asbestos Count*
Insulator No. 1	0.3
Insulator No. 2	0.4
Insulator No. 3	0.4
Insulator No. 4	0.6

*Units of Measurement: fibers/cc--the number of fibers longer than 5 micrometers in length per cubic centimeter (cc) of air

APPENDIX

HEALTH HAZARD EVALUATION 72-91

MOBILE OIL CORPORATION

AUGUSTA, KANSAS

§ 1910.93a Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne cencentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (*a*) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2–1971, which is incorporated by reference herein.

(*b*) See § 1910.6 concerning the availability of ANSI Z9.2–1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices*—(i) *Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) *Personal protective equipment*—(1) Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (*a*) The employer shall establish a respirator program in accordance with the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2–1969, which is incorporated by reference herein.

b. See § 1910.6 concerning the availability of ANSI Z88.2–1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(*c*) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering: (*a*) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*b*) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in (*a*) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(*c*) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400–450 × (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring*—(1) *Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring*—(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring*—(i) samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) *Caution signs and labels.* (1) *Caution signs.* (i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	¾" Sans Serif, Gothic or Block.
Avoid Breathing Dust	¼" Gothic.
Wear Assigned Protective Equipment.	¼" Gothic.
Do Not Remain In Area Unless Your Work Requires It.	¼" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels*—(i) *Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping*—(1) *Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 3 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Employee access.* Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall include, as a minimum, a chest roentgenogram (posterior-anterior 14 x 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records*—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying,

to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.