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DUST PRODUCING OPERATIONS

IN THE

PRODUCTION OF PETROLEUM PRODUCTS AND ASSOCIATED ACTIVITIES

A MEDICO-SAFETY SURVEY

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MEDICO - SAFETY MEMORANDUM

DUST PRODUCING OPERATIONS IN THE PRODUCTION OF PETROLEUM PRODUCTS AND ASSOCIATED ACTIVITIES

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...re to silicate dust.

Asbestosis - According to authorities cited by Drinker & Hatch in their book ...terial Dusts", the pathology produced by asbestos is not like that of silicosis. ... U. Gardner of Saranac Lake is of the opinion that the asbestos fibers group ... the neck of an alveolus and shut it off, causing what is known as "Atelectasis". ...re is no definite migration or transportation of the dust particles to the lymph ...des and no fibrous nodules. As the atelectatic areas increase the reduction in ...ng area causes serious dyspnea or laborered breathing. Dr. A. J. Lanza (U.S. Health ...epts., 50; 1 - 1935) suggests that the enlarged hearts noted frequently in his ...ses of second stage Asbestosis may be due to the increased load on the heart. It ...kes more work to pump blood through the fibrosed than through the normal lung. Re...nt pathological studies from human lungs from cases of asbestosis have indicated a ...ffuse type of interstitial fibrosis with a certain amount of emphysema.

...IV - WHAT IS THE MAXIMUM PERMISSABLE DUST CONCENTRATION? - There appears to be a ...ide variation in the maximum concentration of dust which might be inhaled without ...ubsequent injury to workmen. Some dusts (as lead) are determined by chemical ...ethods and the concentrations in air are recorded gravimetrically as milligrams per ...ubic meter. However, the available information on the amount of lead dust that is ...armful and the methods of determining lead are better and more accurate than those ...or silica dust. It is rather well agreed that an intake of about 1.5 milligrams of ...ead a day, whether this is acquired by breathing dust or by drinking water that con...ains lead, is the maximum allowable quantity. Others (as silica, where size is a ...actor in determining dangerous particles), are usually given by count. Neither ...ethod tells the whole story, but in both cases it may be possible to secure the in...formation necessary for the purpose.

The maximum silica dust concentration considered permissible in the air breath...ed by a workman at any point in the normal breathing zone has not been definitely es...tablished. There is considerable difference of opinion regarding the range of par...ticles that are counted when using the Public Health Service technique and light ...field illumination. Bloomfield of the United States Public Health Service and Brown ...of the United States Bureau of Mines contend that they count particles from one mi...cron and upward, or even 0.7 micron and upward. The Industrial Commission of Wis...consin and its Advisory Committee, composed of both employers and scientists, how...ever, agreed in 1932 on a tentative figure of 15 million countable particles under 10 microns in longest dimension with free silica content of 35 per cent in a cubic foot of air as determined by United States Public Health Service technique. Varia...tions in free silica content will make proportional inverse changes in this standard. In the case of practically pure silica, the permissible dust count should probably never exceed 5,000,000 countable particles. By countable particles is meant those particles between 0.5 to 10 microns in the longest dimension. Particles of this size are the ones that are believed to cause the greatest damage and form no visible cloud. Dust particles smaller than 0.5 microns in the longest dimension are not ordinarily countable. Dust particles larger than 10 microns in longest dimension do not ordinarily reach parts of the lung where they can produce injury of a respiratory nature. Most industrial dusts have but few particles above two or three microns in size. They are usually about 90 to 95 per cent. below two or three microns and 50 per cent. below about 0.5 to 0.7 microns. An exception to this would be a dust sample taken close to the point of generation of dust and before the larger particles had time to settle out of the air.

In South Africa the figure is 1 milligram per cubic meter (or 300 particles per cubic centimeter, or approximately 8.5 million per cubic foot.) Dr. Lanza found in 1917 in the Joplin, Missouri district that with good engineering practice, a figure of 1 milligram per 100 liters of air could be attained. This value attribut...ed to Lanza appears too high in comparison with the South African standards. As there ash.

III - INSULATING OPERATIONS

Insulation plays an important part in the processing of petroleum products. The two types of insulating material most frequently used are "Sponge Felt" (asbestos with ground sponge to give dead air space and thus increase the effectiveness of the insulation) and a mixture of 85% magnesia and 15% asbestos. Rock wool is used to a considerably lesser degree. In the ordinary commercial form, Rock Wool, as used at our refineries, does not present a dust hazard. It is also used for house insulation, and is available in small nodule form which can be blown into place. "85% magnesia" is a mixture of magnesia and granulated asbestos and pressed into blocks of various sizes and shapes (usually 16" x 18" x 1-1/2"). The most dust comes from dismantling old insulation and grinding scrap material for use as a plaster or "ganister". The average service of men engaged in insulating operations is about fifteen years. Most of these men have been transferred from the Common Labor Department. They work nine out of fourteen eight-hour shifts, in gangs of from two to six men, and are actually exposed to dust for less than sixty per cent. of their working time. Goggles are sometimes provided, and occasionally MSA "Comfo" Respirators, but this equipment is not used as much as it should be. Generally speaking, about 85% of their work is with sponge felt and 15% with 85% magnesia insulation. At one of the larger southern refineries about 300,000 square feet of sponge felt and 50,000 square feet of 85% magnesia are handled a year.

A - <u>What Physiological Reactions are Provoked by Insulating Materials?</u> According to Dr. Leroy U. Gardner (Journ. Indust. Hyg. Mar. 1937, Vol. 19, No. 3, P. 121) asbestos dust with its fibrous particles does not seem to be readily handled by the protective mechanism of the lungs. Quoting from his article:

> "They are not removed to the lymphoid tissue but remain in contact with the delicate walls of the air spaces. They become surrounded by an iron-containing coating that fractures and gives rise to the peculiar structures known as 'asbestosis bodies'. The fibers are irritating, perhaps because of their form, and they excite a fibrosis which begins about the terminal bronchioles and spreads to form diffuse patches in the parenchyma. Often the distribution is sub-pleural. In the presence of infection, the reaction to asbestos dust is much more severe than that caused by the dust alone."

There is nothing in the pertinent literature, nor does the Bureau of Mines know of any evidence, which would demonstrate magnesite (a natural magnesium carbonate) to be harmful. It would fall in the class of "nuisance dusts" such as gypsum. While many of the so-called "nuisance dusts" have never been found to be harmful, it is the opinion of most investigators in the field of industrial hygiene that no worker should be exposed to any dust in a concentration exceeding 75 or 100 millions of particles per cubic foot of air.

B - <u>What are the Principal Insulating Operations and How Much Dust is Produced During Such Operations?</u> There is, of course, a wide variation in the amount of insulation work and the amount of dust produced. A few examples, however, will give a good general idea:

> INSULATING 12" STEAM LINES: 6" x 18" x 1-1/2" blocks of 85% magnesia are tied on the steam line with 14-gauge galvanized wire and covered with roofing paper to make it waterproof. Often times this work is performed on scaffolds twelve to fifteen feet above the ground,

siderable dust (as high as 18,124,800 particles of less than ten microns per cubic foot) results from tapping the blocks into place. Samples taken during the entire operation had an average concentration of 6,881,760 particles per cubic foot. About 90% of these dust particles were slightly angular, crystalline in appearance and above five microns or less in size (as seen under the Konimeter Microscope); 5% were rounded opaque, ten microns or more in size; and 5% were opaque scale-like, five microns or more in size. Samples taken while applying asbestos sponge felt to a 12" steam line had a dust concentration as high as 23,788,800 particles of ten microns or less in size per cubic foot. The average was 12,574,080 particles per cubic foot. These dust concentrations are considered too high for working without adequate protection.

INSULATING A 750-POUND CRACKING COIL ACCUMULATOR: 6" x 36" blocks of Johns-Manville "Fire Felt" are first applied and plastered with extra AA Rubberoid Asbestos Cement and waterproofed with Johns-Manville "Insulkote". The dustiness of handling these materials has been considerably reduced since the manufacturers began shipping the "Fire Felt" in cardboard cartons containing thirteen or twenty blocks, and the plaster in hundred-pound paper bags. Samples taken during this operation had an average dust concentration of 4,502,880 particles, ten microns or less in size per cubic foot. About 75% of these dust particles were slightly angular in appearance, five microns or less in size; 10% were scale-like; opaque; and 15% were rod-like and fibrous.

INSULATING TREATING PLANT ACID SUCTION LINE: Sections of "Sponge Felt Pipe Cover" are cut to fit pipe lengths with an ordinary carpenter's hand saw. This operation produces on an average 821,280 particles of dust, ten microns or less in size, per cubic foot. Under the Konimeter Microscope all of these particles are slightly angular, crystalline in appearance, and five microns or less in size. The blocks or sections of the pipe cover are held in place by wrapping #16 gauge galvanized wire about each one.

INSULATING CRACKING COIL HOT OIL LINES: All hot oil lines at cracking coils are insulated with 2" asbestos tubing (85% magnesia and 15% asbestos) held in place by fine copper wire. Sections of the tubing are cut to fit particular areas by means of an ordinary carpenter's hand saw. This produces 7,788,000 particles of dust, ten microns or less in size, per cubic foot. Under the microscope, 90% of these dust particles appeared to be rounded crystalline and about three microns or less in size. Each section of tubing is pounded into place with the open hand so that it fits snugly against the pipe, and then wired into position. The dust produced from both of these operations averages about 3,379,520 particles per cubic foot. Under the microscope, approximately 80% or 90% of the dust particles appear crystalline, more or less angular, and five microns or less in size; the remaining 10% or more are rounded in appearance, and over ten microns in size.

DISMANTLING OR REMOVING OLD INSULATION: As a general rule, the dismantling or removal of old insulation is a more dusty operation than the application of new insulation. The old insulation is chopped or cut with a hatchet or small hand-axe, and pried loose and pulled off with the hands. This produces dust concentrations as high as 5,890,560 particles, ten microns or less in size, per cubic foot. In

...tling an old cracking coil 4" tar line, the average dust concentration was 2,322,240 particles per cubic foot. In appearance these particles were clear crystalline, rather rounded, and five microns or less in size. No fibres were observed in any of the dust samples from dismantling operations. After a few weeks or months service, insulation on hot lines dries out and appears to disintegrate. This is probably due to the fact that such insulation is usually covered with a weather-proof material which prevents absorption of moisture from the air.

CRUSHING SCRAP ASBESTOS: Scrap asbestos insulation, usually the 85% magnesia type, is crushed in a belt-driven Williams crusher to pass through a screen with one-inch holes or slots, and is then mixed with new asbestos to make insulating plaster. This operation, which is a very dusty one, is performed by two men, with an average service credit of about twelve years. Goggles and MSA. "Comfo" or Willson Dust Respirators are worn. Considerable dust is produced in breaking up the scrap insulation by hand prior to crushing (10,195,200 particles, ten microns or less, per cubic foot), and also when feeding the crusher which is done by shovelling the broken-up pieces into the hopper and poking them down with a short wooden stick (14,839,680 particles per cubic foot). Dust counts as high as 27,527,040 particles per cubic foot were found in samples taken from over the hopper. These dust concentrations are dangerously high. About 95% of these particles are sharply angular, crystalline in appearance and five microns or less in size; 5% are opaque scale-like, six microns or more in size. Crushing scrap asbestos is not a steady routine operation, the exposure varying from eight hours a month to about twelve hours a week.

CRUSHING OLD CORK INSULATION: This operation is performed approximately twice a year and takes about twenty or thirty minutes. The insulation is crushed on a belt-driven Williams crusher, by the same men who crush the scrap asbestos. This crushed cork is used for insulating lines in the cold settling plant. The average amount of dust produced is 20,016,178 particles, ten microns or less in size per cubic foot. About 80% of the particles are slightly angular, crystalline, in appearance, and five microns or less in size; 20% are round, semi-opaque, ten microns or more. There are also a large number of very small black or dark gray specks.

IV - GUNITING OPERATION

<u>What is Gunite and How is it Applied?</u> - Gunite is a mixture of approximately ...rt (one 94 pound bag) of Portland Cement and two parts (twelve scoop shovels) ...an sharp sand. The sand and cement are mixed dry, shoveled into the hopper ...unite machine, using water under about 40-pounds per square inch pressure and ...ssed air at thirty to ninety pounds per square inch. It is applied under pres... as a semi-fluid, against the surface to be protected (usually process equipment, ...s, cracking coil soaking drums and storage tanks). In practically every case ...guniting is done, it follows immediately, after the sand blasting job used to ... the surace. In most cases, the work is performed by the same crew. The indi... holding the gunite nozzle is provided with the same protection as is the ...or of the sand blast nozzle, and the men tending the gunite machines are pro... with respirators and are required to use them while actually handling the sand ...ment. This involves mixing the materials and charging them into the machines ...wo dustiest parts of a guniting job). Samples taken during these operations ... following dust counts of particles ten microns or less in size: