AN

INDUSTRIAL HYGIENE SURVEY

OF THE KENSINGTON PLANT

OF THE SHERWIN WILLIAMS COMPANY

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THIS IS A CONFIDENTIAL REPORT

4. Lead

In this plant, the foremost practical hazard is to lead poisoning. Many varieties of lead compounds are made in this plant, all ultimately starting with pig lead. As is well known, the group of lead compounds included as foremost are white lead, red lead, litharge, lead acetate, leaded zinc, various lead pigments, usually produced as compounds with chromium. Also lead is found in the form of terne plate in the tin can factory, and is manipulated in many fashions in many departments.

Lead chiefly enters the body through the lungs, after the inhalation of lead dust. Lead fumes are less important than lead dust as a source of lead poisoning. Some lead is ingested, being carried into the mouth by fingers, in connection with consumption of food, smoking, chewing tobacco, etc. Ingested lead is only about 1/5 as significant as inhaled lead. Inorganic lead compounds do not go through the skin in appreciable quantities. Some organic compounds do, such, for example, as tetraethyl lead used in the manufacture of ethyl gasoline.

As elsewhere discussed in greater detail, lead is highly distributed throughout this plant. It may be detected in small quantities in offices. Some lead may be detected in the outside air in buildings, manipulating lead in large quantities. The minimum amount of lead that may cause lead poisoning varies from person to person and for any given person depends in large measure upon his own individual body economy. There is, however, no such thing as complete tolerance to lead. Ordinarily it is accepted as a fact that 1.5 milligrams of lead in ten cubic meters of air is sufficient to induce lead poisoning in some workers. This ten cubic meters of air is roughly the quantity of air inhaled by the average workman on an average work day. It is probably true that most workers will not acquire lead poisoning from this low threshold, but instead will require larger amounts before any evidence of lead poisoning is evinced. In our experience, large numbers of workmen have been exposed to such quantities as eight milligrams of metallic lead per day without acquiring lead poisoning. In view of the fact that an occasional worker may respond to very trivial amounts, this standard of 1.5 milligrams has been widely accepted as a standard governing protective measures.

In the case of ingested lead, some compounds are much more toxic than others. This depends upon the solubility of the lead. The more readily soluble preparations are conducive to lead poisoning and vice versa. In the case of lead inhalation, less significance is to be attached to solubilities, as ultimately all lead compounds are dissolved and all are toxic. The old idea that metallic lead is non-toxic is probably not justified. At least in the form of fine dust, metallic lead is later oxidized so that the responses of the body are to lead oxide rather than to metallic lead.

In this plant, making very extensive use of lead, large numbers of workmen have been subjected to certain blood tests, suggestive of lead absorption. In addition, large numbers of samples of atmosphere presumably containing lead have been analyzed. The results of these procedures make up special sections of this report.

Lead in one form or another is used in the following departments of this plant: Tin Can, Pigment Products, Chemical Products, Dry Color, Paint and Varnish and Lacquer.

For the purposes of this report, lead is accepted as the dominant exposure in this plant, which fact is well recognized. Much of the entire program of industrial hygiene must necessarily center about the prevention of worker exposures to lead. At the time of the writing of this report, a fair number of workmen are presenting borderline conditions suggestive of lead poisoning.

5. Chromium

Chromium, in the form of the chromates, oxides and compounds with lead, provides various widespread exposures in this plant. With respect to injury to human beings, chromium is a peculiar substance. First, it is so very slowly hydrolyzed when in contact with tissue that its action may persist over periods of weeks. This is responsible for the well known term "chrome hole", which is a burrowing ulcer more or less jug shaped, with a small opening at the skin surface, but with undermined edges and enlarging area of damage. In the second place, not all of the chromium compounds are harmful. Certain valences yield toxic bodies while others do not. A third peculiarity resides in the fact that chromium, while able to attack the unbroken skin, is much less apt so to do than to attack a skin which is chapped, cut, blistered or otherwise broken. Apart from "chrome holes" of the skin, the chief site of action of chromium is the nasal septum, which is often perforated and irreparably so. This leads to no disability, although septal perforation may lead to disturbing whistling through the nose and may pave the way for sinus and other nasal diseases.

Chromium rarely leads to generalized disease. Some persons may become sensitized to its action so that responses are brought about on the slightest exposure to chromium and at sights other than those in direct contact. It is also true that chrome compounds in the form of dust or vapor may reach lung tissues through inhalation and may set up bronchitis or other inflammatory processes. This is, however, the exception and not the rule. Lately the claim has been made that chromium compounds may lead to cancer of the lung. This is recognized as a remote possibility and in any event the action of chromium will not be more specific than other irritants reaching lung tissues. In this plant, chromium finds some application or manipulation in the following departments: Chemical Products, Dry Color, Paint and Varnish and Lacquer.

6. Manganese:

Comparatively small quantities of manganese in a variety of compounds find use in several departments in this plant. Manganese leads to a bizarre disease called manganese poisoning, which chiefly has arisen as a result of exposures to manganese oxides. At this time, there is no reason to believe that other compounds of manganese may not be similarly injurious. When the substance enters the body (chiefly through inhalation of dust), the disease state is brought about, in comparatively short time, such as three months and even less. Naturally, in some measure, this depends upon the concentration of the dust to which exposure is provided. Without any pain or any quick changes, workers exposed to manganese may be noted to develop periods of excessive laughter or crying, unassociated with any adequate cause. At about the same time, it may be observed that their facies become mask-like, immobile, expressionless. At a little later stage these workers, when walking or running, are unable to stop until they run into some object or grasp some projecting structure. They are apt to fall down, particularly when taking steps backward (retropulsion). They are unable to stop their movements until they fall or bump into some object. During this process, these workers may have their mental faculties unimpaired, but are no less totally disabled. In time they become completely paralyzed in portions of the body, such as the arms and legs and may live long lives of total invalidism without any prospect of recovery.

At the time of the writing of this item, no suspicion has arisen that manganese poisoning prevails in this plant. The circumstances of the use of these materials seems to preclude any practical extensive exposure.

7. Tripoli

In this plant, tripoli is commonly referred to as "mixed silicates". These statements probably are not true. Instead, trpioli is a crypto-crystalline variety of quartz and is composed to an extent of about 99% of free silica. The mining of this material is limited, so far as known, to two areas in the United States, namely Southern Illinois and the Seneca area in Missouri, which extends over into Oklahoma. In the latter district, the beautiful rose and cream colored tripolis are found.

Tripolis possess peculiar electrostatic properties so that fine materials thrown into the air glomerate into heavier balls and drop to floor levels. On this account, cases of silicosis from tripoli are rare, although not unheard of.

Since tripoli is in fact quartz, reference is made to item one, in this series, for discussion of the disease that may be produced by it. In this plant, tripoli is used in the following departments, in limited amounts: Lacquer only.

Dust counts have been made in connection with its use and x-rays have been made of selected workmen longest exposed. The results obtained from these procedures are set forth in other sections.

8. Zinc Sulfate:

The raw material from which lithopone is made, as operations start in this plant, is zinc sulfate, received from the Coffeyville Plant, in a dry lumpy state, which is conducive to dustiness. Although lithopone with its content of zinc sulfide is rated as non-toxic, its precursor, zinc sulfate, possesses properties conducive to harm the workmen. This is manifest chiefly in the form of perforation of the nasal septum and low-grade ulceration or at least inflammation of the nasal passages.

Work carried out about ten years ago with zinc sulfate by these investigators revealed a fairly high frequency of gastric or duodenal ulcer, which was attributed to the action of zinc sulfate. Therefore, it is regarded as within the realm of possibility that increased frequency of gastro-intestinal ulcers might arise among zinc sulfate workers in the lithopone industry. Thus far no evidences have arisen, although no real search has been made for this disease.

Zinc sulfate, so far as known, is only handled in the lithopone department in this plant. There workers are supplied with respirators and no substantial exposure is known to exist. No less, this matter is discussed in greater detail in another section devoted to the lithopone department. Barium as a constituent of lithopone is elsewhere discussed.

9. Cadmium:

Cadmium is found in this plant in two dissimilar sets of circumstances. First, cadmium is removed from the zinc sulfate as a preliminary to the manufacture of lithopone. This cadmium is reduced to the metallic state through recovery processes elsewhere described and discussed. The second aspect of cadmium present is in connection with its use as a pigment material in the Dry Color Department and to a minor extent in Chemical Products and Lacquer Departments.

Wherever it may be used, cadmium is a treacherous substance. It is more toxic than lead, but perhaps not ten times as toxic as lead, as is sometimes claimed. One milligram per day, taken into the body, is dangerous. Usually the entry into the body is made through the portal of the respiratory tract, dust or fume entering in this fashion. However, swallowed cadmium may also lead to poisoning. In any event, the manifestations chiefly center about the gastro-intestinal tract, together with some involvement of the kidneys and liver.

In view of the dangerous properties of this substance, various tests have been made, the results of which are elsewhere set forth.

10. Carbon

Many varieties of paint coatings contain carbon for black pigment purposes under a great variety of names, such as lamp blac, bone black, cosmic black, etc., etc. Some of these substances at least are of such physical properties as to provoke great dustiness when they are handled. This dust is inhaled and later on the workman's attention may be drawn to the fact that he is spitting up black tinged sputum. This may persist for some weeks after the last exposure. Workers may become highly concerned and attribute all of their respiratory infirmities to an imagined action of this dust.

The facts in the case are somewhat as follows: While no dust is entirely innocuous, carbon is one of the least harmful. Its entry into the body leads to the condition known as anthracosis, a minor abnormality from which all of us suffer. At autopsy every adult will show some signs of anthracosis. Urban dwellers are prone to present well blackened lungs at every autopsy. Apart from this black pigmentation, carbon produces no noteworthy disease. However, attention has been drawn to the fact that some carbon preparations contain oil and that others have been mixed with silica as an impurity. Under such circumstances, it is possible that these extraneous materials may bring about their own diseases, which no less may be laid at the door of carbon. It is the intent of this discussion to rate carbon dust when inhaled as an innocuous material, worthy of little hygienic consideration.

11. Asphalt

Under this term, there are included, for the purposes of this report, many substances that are not natural Trinidad asphalt. These include petroleum and coal tar pitches or residues, Gilsonite, Tailings of various sorts, stearine pitch, etc. Chemically, all of these substances represent mixtures, the exact composition of which is little known. When these substances are in dry state, they present little opportunity for injury from contact. Contrariwise, when they are naturally liquid, or when they have been cut back, or when in liquid state through heating, they are more likely to bring about injury on contact. These substances are sources of skin irritation for some workmen. In contact with the skin, these materials are removed with difficulty. Satisfactory personal hygiene is not easily obtained and in the absence of a real dermatitis, there may slowly develop a condition characterized by numerous large blackheads (comedones), largely the result of ordinary dirtiness. This stage may progress to one of furunculosis, characterized by multiple small boils, abscesses, etc. When such materials are used on roadwork, they are ordinarily heated to high temperatures and the vapors thus arising are highly irritating to the respiratory tract. It is not known that paint manufacture leads to similar operation, but if so this operation should be carried out only in the open or else under hooded conditions.

12. Nitrocellulose

The public entertains a fair amount of apprehension against the action of nitrocellulose. This is unwarranted. At least the nitrocelluloses employed in coatings and in their natural state are free from dangerous potentialities. Nitration has not proceeded to that percentage corducive to explosibility. On the other hand, when nitrocellulose is burned, there may be produced one or more of a series of the oxides of nitrogen, several of which are exquisitely active in producing pulmonary edema and edema of the entire respiratory tract. After breathing a few breaths of nitrogen oxide containing air, sufficient harm is wrought so that a few hours hence, such as 6-18, enormous edema sets in, occluding the passagesfor air and leading to death of the victim through internal drowning.

The various grades of nitrocellulose used in coating preparations are apt to be received in the wet state, the wetting being brought about by the action of denatured alcohol. In practice, the denaturant much used is wood alcohol, present to the extent of 5%. In the cutting of nitrocelluloses for lacquer purposes, this content of ethyl alcohol and wood alcohol is of no great concern. However, in a few processes, such as the manufacture of lacquer chips, disagreeable work conditions may result from evaporation of large quantities of alcohol in closed areas. Dangerous fire hazards may be produced and on occasion conditions favorable to explosion may arise.

13. Beta Naphthol

One large section of this plant is devoted to the manufacture of beta naphthol. This work is carried out under favorable conditions, and the casual visitor at once gains an unfavorable impression of this operation. Workers in this department make complaints about the disagreeableness of the work, but as yet no one has been able to prove that beta naphthol produces any serious disease. It is irritating to the eyes and mucous membranes, may lead to lacrymation and sneezing, occasionally produces some skin disease; occasionally, cystitis arises in beta naphthol workers.

14. Paraphenylenediamine

In the case of most dyestuffs, the final product is apt to be non-injurious, while intermediates may be quite to the contrary. In the case of paraphenylenediamine, both the intermediates and the final product are worthy of respect. In another section is presented discussion of the manufacture of this dye. It is best known as a dye for hair, fur, feathers, woolen materials, etc. All diamines are said to posses harmful properties, although considerable differences may exist between the actions produced by different members of this group. This dye leads to three different types of manifestation, a) asthma, b) edema, c) skin eruptions. It is not unusual for the wearer of a cheap fur, dyed with this material, to develop extensive swellings of the face, lips, ears, etc. Fur workers in particular may suffer from asthma produced by the dust from furs dyed with paraphenylenediamine The skin disease created has no special characteristics and resembles many other occupational dermatoses. While no large experience has grown up relative to injuries produced to workmen in the manufacture of this dye, it is no less labeled as an outstanding example of dangerous dyestuffs.

15. Zinc Oxide

This well known substance is blamed for more occupational diseases than it is capable of inducing. As used in the paint industry here, it is almost wholly guiltless and an inert agent. In ointments, lotions, it is perhaps the most widely used of all treatments for skin diseases. High concentrations of its dusts will at most produce nothing more than a harmless increase in the fibrous tissues of the lung. Regardless of the concentration of exposures and its duration, zinc oxide will never lead to a dusty lung disease, analogous to silicosis.

On the other hand, zinc oxide, under certain circumstances, may lead to what is variously known as zinc chills, spelter chills, brass workers' chills, zinc ague, metal fume fever, etc. These conditions which, in fact, are but one, are quite genuine and are due to the inhalation of recently produced zinc oxide, such as arises in connection with galvanizing, brass founding, zinc founding, zinc smelting, etc. Here the zinc oxide in its recently formed state is in a peculiar physical condition known as its "dispersed" phase, in contrast to its "flocculent" state, which is the state of the material found in the paint industry. Thus, the toxic properties of zinc oxide are limited to a few operations which do not include the use of different varieties in paint manufacture.

16. Iron Oxide

Iron oxide in a great variety of colors, finenesses, chemical forms are found in the plants of this organization. Some of them represent mixtures with silica, silicates, carbonates, etc. Of pure iron oxide, it may be said in full sincerity that no proof exists that it causes any harm to exposed workmen. These substances are commonly dusty. Dust may be taken into the lungs. Instead of producing a condition similar to silicosis, it produces no condition other than staining of the mucous membranes, imparting their color to saliva and sputum. In the legal world, many cases of dusty lung diseases or alleged dusty lung diseases have been attributed to the action of iron; steel dust has been said to produce a profound bronchitis. None of these claims are known to be justified, or founded on any substantial evidence. It is true that the human body should not be subjected to long continued exposure to any dust. It is true that from soiling of the skin, some injury may arise in the way of low-grade skin disease, but it is not true that these substances constitute real hazards in this plant or anywhere else.

Here they are chiefly used in the following departments: Paint and Varnish, Chemical Products, Dry Color, Lacquer.

17. Lithopone

Lithopone is a mixture of zinc sulfide and barium sulfate. This present meager discussion does not embrace the methods of manufacture of lithopone, merely the toxic properties of the finished product. These statements, which refer to the ordinary varieties of lithopone, do not contemplate forms such for example as those that might contain lead. Barium sulfate, one component of lithopone, is that used in medicine in making of xrays of the gastro-intestinal tract, which fact serves to attest its harmlessness. Zinc sulfide is equally harmless. The admixture of the two provides a coating material which has served an enormously useful purpose in freeing painters from the earlier, almost universal use of lead. While lithopone is by no means the only lead-free white pigment, it is outstanding in its contribution to the protection of painters against the action of lead. Further, a useful purpose has been served through the substitution of this paint or other non-lead paint in the painting of the interiors of nurseries, kindergardens, etc., where some danger existed that immature persons might chew up flaked off lead, etc.

18. Titanox

Titanox is a trade name for titanium dioxide. However, the term is loosely applied to a variety of titanium mixtures or compounds, such as with barium, lithopone, white lead, etc. With respect to titanium dioxide itself and perhaps to other oxides of titanium, there is no proof that this substance is harmful. Lately, one or more papers have been published describing a new dusty lung disease called "titanosis". In view of the fact that many hundreds of workmen over the country have been grossly exposed to dusts from titanium over a period of years, it appears that this claim of a new dusty lung disease may be unwarranted. At any rate, those persons most familiar with dust diseases fail to recognize titanium as a contributor to this class of affections. As often pointed out in this series of discussions, no dust serves any useful purpose when breathed by workmen in high concentrations over a long period of time. No less, if a person were required to breath a dust and given a choice of all mineral dusts, titanium would probably represent the wise choice of intelligent persons.

Under experimental conditions, these investigators lately have injected titanium into animals, along with a great variety of other dusts, including silica, silicates, clays, carbonates, coal, coke, etc. Of all dust so introduced, the most harmless variety proved to be titanium dioxide in pure form.