MEMORANDUM CONCERNING THE FOUNDRY IN THE PLANT OF THE JOHNSON BRONZE COMPANY OF NEW CASTLE, PENNSYLVANIA

The plant in question was visited on March 30, 1943, in the company of Mr. H. R. Bryant of Robert F. Coleman, Inc. and his associate Mr. McGill, and Mr. ~~Chalfonte~~ Williams W. Chalfonte, Jr. an attorney representing Robert F. Coleman in the case [redacted] vs. Johnson Bronze Company. The afternoon of this day was spent largely in the discussion of the available facts in the [redacted] case. Mention is made of the case in this memorandum solely for the purpose of illustrating a point that will be referred to later - that there were no medical records in the possession of the Johnson Bronze Company from which the facts could be obtained or on which any medical defense against the claim could be based. Such facts as were available were fragmentary, wholly inadequate, and so far as they went were such as to show that the deceased [redacted] had been retained in employment long after he should have been removed from hazardous lead exposure. But for the availability of records obtained by physicians who had no responsibility toward the Johnson Bronze Company, the nature of his illness could not have been surmised and the assumption that he died of lead poisoning would have been justified for purposes of compensation. Under present circumstances similar cases can be expected to occur, and it is imperative that the management of this industry have the information that will enable it to know the medical status of its employees, not only for the purpose of safeguarding their health but for the protection of the industry against ill founded and mistaken claims of occupational illness. Specific recommendations will be made for the purpose of fulfilling this urgent need, in a subsequent part of this

memorandum.

A second visit was made to the plant on the following day, primarily for the purpose of inspecting the foundry and ascertaining its status from an hygienic viewpoint. Conversation with the superintendent of the foundry, with the engineer concerned with safety, and with the foreman and assistant foreman in the foundry revealed many significant facts, while detailed examination of the premises from the top of the roof to the ground floor supplied necessary details concerning the sources of fumes and dusts and the methods undertaken to control their dissemination. The essential facts may be summarized without reference to the means by which they were ascertained.

The hazards arising from exposure to lead compounds are doubtless the most important to be considered, and these will receive the most detailed attention. Nevertheless there are other potential hazards which should be looked into, such as the exposure to cadmium and to silica. Fortunately the measures which will be recommended to reduce lead exposure will also help in the case of cadmium. The exposure to silica, on the other hand will require some additional consideration.

Lead exposure in and around the foundry

Lead-containing materials in the atmosphere of the foundry exist in two forms, - (1) fumes given off from mixtures of metals melted at high temperatures, and (2) dusts arising from materials contaminated with lead, from the condensation and settling of fumes, and from the fragmentation or virtual pulverization of metals handled under a variety of conditions. Both fumes and dusts contaminate the air breathed by workmen. At certain points, such as around the fur-

naces and pots, (the fumes go wherever the pots are taken, and therefore the bays are heavily contaminated at times), fumes are given off into the air in high concentration. These fumes are distributed irregularly through the foundry, and no doubt their concentration varies greatly from time to time. The ventilation of the furnaces is fairly effective, but the fumes that are removed are discharged to the outside of the plant in such a manner and at such levels as to provide ample opportunity for their return into the foundry through windows and other openings. The fumes in the bays are not removed effectively, the ventilation here being quite unsatisfactory in volume and design. Dust from the sand-reclaiming equipment is very badly handled, and is generously distributed. In general the dusts are removed inadequately but to a considerable extent, and these as well as condensed fumes and debris from the furnace stack (cupalo) drop down on the flat or gently sloping roofs, from which a portion of them are swept back into the shop and all other workrooms of the plant, as well as into the foundry, by every air current or breeze that moves in the proper direction. A very considerable proportion of the dangerous material that is removed by ventilators and stacks is being reintroduced into the plant and recirculated, this being facilitated greatly by the fact that the foundry is under a continuous suction so that contaminated air is being drawn in at every opening.

In addition to the reintroduction of contaminated air from the outside, the dust that arises from inadequate housekeeping is prevalent everywhere. Rafters, ledges, sills, and even the tops of lockers in the wash-room are burdened with dust. This dust is also picked up by the strong air currents and is added to that which ori-

quate and as indicated above they are not clean. Under present circumstances they cannot be kept clean. The men do not change clothing before and after going to work and therefore they are not free of lea exposure when out of the plant. They eat and handle food and beverag in the foundry and while at work and therefore they contaminate their food and drink. They are not supervised in such matters and therefor they do not do as well as could be done under the circumstances. Nevertheless the inadequacy of the facilities for promoting cleanlin is an important factor in this situation.

Some point was made at the plant of the fact that the men do not bathe regularly and that for this reason they may be exposing themselves to unnecessary risks. This is undoubtedly true, but the nature of the lead exposure arising from this situation should be made clear. The inhalation of lead fumes is undoubtedly the greatest source of danger to the workmen. Next in order of importance comes the inhalation of dust, the particles of which are larger than those of the fumes-and are therefore less readily inhaled and absorbed. Ne

all of its accessory areas, including the wash-room, locker-room, toilets, and lunch-room is deplorably and unnecessarily filthy. Unde these circumstances it is not possible for the men to be clean, and it is inevitable that they should have failed to develop any habits conducive to self-protection against lead exposure. They eat dusts with their food, and they inhale dusts even in the periods when they are eating or relaxing in the rooms available for such purposes.

Respirators are available for certain of the operations. These are not of the type that protects against fume, and their use is desultory, there being no supervision or regulation of their use and no systematic care of the respirators. The facilities with respect to wash-rooms, lunch-rooms and locker-rooms are wholly inade-

comes the swallowing of lead compounds, both those caught in the upper respiratory tract and then swallowed, and those taken in with food, tobacco and other articles contaminated with dust before being introduced into the mouth. Least important, and in fact of no practical importance at all, is that which is absorbed by the contaminated skin. It has been shown that none of the inorganic lead compounds are absorbed in appreciable quantities through the skin. The dirtiness of the skin and clothing is important therefore, only because it gives inhaled, and contaminates articles that may go into the mouth. This unnecessary source of lead exposure can be avoided except during the actual work periods. Because it is avoidable by means that can readily be made available even at the present difficult time, stress will be laid on recommendations to this

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the fact that there have been more complaints of illness among the workmen in recent months than in any previous time. A number of factors have combined to bring this about. There is no doubt that the lead exposure is greater during the winter months because of the poorer ventilation of the foundry in cold weather. We have noted this same condition in other similar foundries. Moreover, the hours of work are longer than they were formerly, thereby providing a proportionally greater exposure. (The extent of the lead absorption is determined by two factors, (1) the intensity of the exposure, and (2) the length of time over which it occurs.) Other factors probably contribute something to the actual increase in the lead exposure. An

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information were not readily available. Mention is made of certain of these points in order that information may be obtained on them in the future. For example, the actual quantities of the various metals used up in a given period of time provide a good index of the over-all exposure to these materials. More specifically the frequency with which alloys of high lead content are employed in a given period of time, and the total output of bearings of such high lead content as compared to those of low lead content, will give invaluable information concerning the exposure. In other words, other things remaining unchanged, lead exposure and the incidence of lead poisoning because of it, will correlate with the quantity and proportional make-up of the product handled in the foundry. The exposure will also be influenced by the weather and the composition of the population of the foundry, i.e. whether constant, or inconstant by reason of rapid labor turnover or rapid increase or decrease in number. In a well regulated industry it should be possible to weigh these factors carefully by means of records that are kept in convenient form for examination. The factors that influence industrial health from month to month or from season to season should be surveyed and appraised systematically just as the factors that are directly concerned with production, cost accounting and similar plant activities.

In addition to the foregoing factors that influence the severity of lead exposure, there is anxiety among the men at present that induces a greater frequency of complaints. Every minor illness is regarded with apprehension, lest it result in serious illness or even in death. The correction of the latter situation can be achieved only by medical means, and therefore somewhat detailed suggestions and

recommendations will be given along this line.

A considerable amount of attention has been given by the management to the installation of ventilating equipment to correct some of the worst features of the present condition in the foundry. The program contemplated was looked into. It appears to be in accord with the principles that must guide all successful attempts of this kind, in that; (1) it provides for the collection of dusts and fumes, rather than merely drawing them out and dumping them into the surrounding atmosphere to be deposited elsewhere or reintroduced into the plant; (2) it provides for the introduction of clean tempered air to replace that withdrawn by suction, and (3) it tends to make the ventilation independent of the natural openings of the foundry, in recognition of the fact that the latter serve not to help but to unbalance a properly designed ventilating system. As far as it goes, the plan appears to be good, and it is believed that none of the items of equipment that have been ordered will be wasted. However, the equipment will probably not be available for some time and meanwhile every effort should be made to bring the lead exposure under better control. Moreover, the program contemplated has not been designed to complete the job of ventilation in the foundry. It seems advisable that careful and detailed attention be given to the possibility of rearranging the foundry before an attempt is made to complete the ventilating equipment. If the furnaces and the pouring operations could be located in one part of the foundry, a carrier system could be arranged to convey the molds to the pouring site. By this means the hazardous operations could be concentrated in one well ventilated area, and the men engaged in intrinsically non-hazardous occupations would

not be exposed to lead fumes and dusts. The unfortunate aspect of the present lay-out of the foundry is that most of the workmen need not have any lead exposure if the plant were properly designed. A further practical point is that by distributing the hazard throughout the foundry it becomes necessary to ventilate it all. The ventilation must be unnecessarily expensive, therefore, if it is to be effective, and in addition the difficulty and expense of maintaining reasonable temperatures in the foundry in cold weather are greatly multiplied. The objection has been raised that the use of a conveyor system in a foundry of this type does not provide for the many types of alloys that must be used. This objection does not appear to be valid, since a multiple conveyor system could be used withmultiple units of melting and pouring equipment.

Regardless of the equipment eventually installed for the removal of fumes and dusts, this is but one aspect of the problem. It will be necessary in any case to set up something approaching adequate medical and general hygienic facilities. Without these it will not be possible to determine what the hygienic status of the plant really is now or at any future time. Lacking such information the management of the plant will always be in the dark with respect to the likelihood of difficulties among the employees based on actual or alleged complaints of occupational illness.

Recommendations

I. The first requirement is to set up a satisfactory type of medical supervision of the workmen. Conversation with Dr. David Perry has served to demonstrate that this can be done to the extent of the time that can be made available by Dr. Perry. As time goes on it is to be expected that more time will need to be given to direct medical work in the plant. At present what is done should be correct in principle after which it can be expanded as conditions require and circumstances permit. The medical activities that should be undertaken immediately are as follows:

(1) All the men now employed in the foundry and all applicants for future employment should be given careful physical examinations, the records of which should be complete. These records should be in the custody of the plant physician to be held by him in that degree of professional confidence that accords with ethical medical practice.

(2) The medical records should contain the history of employment, a satisfactory general medical history, the details of a physical examination, and notations concerning advice given or treatment recommended.

(3) Laboratory examinations should be made in the case of each man, consisting at a minimum, of examination of the urine for albumin and sugar, and examination of the blood to determine the number of erythrocytes, the number and type distribution of leucocytes, the hemoglobin content, and the number of stippled erythrocytes per million erythrocytes. Other laboratory tests may be carried out in accordance with the requirements of the case at the request of the physician. Stereoscopic chest roentgenograms may be necessary in some instance

especially if there is reason to suspect significant exposure to silica, as in the case of some of the molders. Serological tests also may be required in some cases. In many industries these are required routinely. The advice of the plant physician on this point should be followed.

(4) All men whose clinical picture suggests the existence of lead intoxication should have lead determinations made on the blood and urine, as a means of substantiating or eliminating that diagnosis. If local arrangements can be made to have such tests carried out, this work can be done locally. If not, this Laboratory is prepared to carry out such tests at cost for such a period as may be necessary for the maintenance of the program recommended. Detailed information on this point will be supplied to Dr. Perry, in the expectation that he as the responsible physician will express his wishes to the management for their consideration.

(5) Periodic re-examination of the workmen and periodic rechecking of the laboratory findings should be carried out at such intervals as may be necessary and feasible. The frequency with which this should be done will depend upon the actual severity of the exposure encountered by workmen in the foundry. It is anticipated that observations will be made to determine the extent of the exposure (see later recommendations in this regard), and that recommendations as to the frequency of the periodic examinations can be based thereon. In any case, in view of the facts of recent months, it is believed that the blood examinations (microscopic) must be repeated at quarterly intervals. In the case of persons whose condition justifies the suspicion of undue lead absorption they will have to be done at more frequent intervals at the discretion of the plant physician.

(6) The plant physician should visit the plant daily to

his opinion justify such examination. He should supervise the nurses in all their work and should provide standard written orders for the handling of all types of injuries and illnesses. In other words he should direct all medical activities in the plant in detail and should keep himself informed of all that transpires that may be related to health and medicine.

(7) The plant physician should inspect the plant carefully at once, and at intervals. He should keep himself familiar with all the operations, with the various types of work in which the men are engaged, and with all changes that take place from time to time, to the end that he will understand the opportunities for hazard that occur normally or under unusual circumstances.

(8) The recommendation of the physician, with respect to the disposition of men who are ill, and for the transfer of men to less hazardous jobs for medical or hygienic reasons, should be regarded as mandatory. It is only under such conditions that he can be expected to accept responsibility for the safety of the men, and that he can hope to gain the confidence of the men in his professional efforts on their behalf.

II. The second main necessity is to determine the present status of the men in the foundry, with respect to their lead exposure and absorption. Air analyses have been made previously, but it is not certain that the results of these are representative of the facts at present. Certainly they cannot give the information that is needed with respect to the exposure of the men, for they fail to take into account lead that may be swallowed as the result of the conditions previously discussed.

It is believed that the best approach to this problem is

to obtain samples of urine and feces from selected men representative of the various occupations in the foundry and in the rooms accessory to the foundry. This will involve the careful selection of men on the basis of their reliability, their general stability with respect to the likelihood of apprehension on their part, their willingness and ability to follow the simple instructions that are necessary for the collection of satisfactory samples, and the length of their service in a particular capacity. Men who have been in the employ of the Company for some time are especially desirable for this purpose. All classes of employees should be represented if possible. If this is not possible, a limited number of carefully chosen men will provide the best samples. The men chosen should spend all their working day in the foundry. The foreman and assistant foreman, one or two each of the furnace men, pourers, molders, shakers, sand conditioners, and checkers may best be studied. A janitor should be included, as well as a maintenance man if available, and a laborer who has been spending some time in the metal washing room, without entering the foundry. A few men from shop areas contiguous to the foundry would also be useful subjects.

Containers for the collection of these samples will be supplied in sealed bags. These should be given to the men when they are ready to go home, after cleaning up and changing clothes. Written instructions will be provided for each man, and in addition oral instructions will be provided for issuance by the person who accepts the responsibility for this work.

The fecal samples will reveal the general magnitude of the exposure to dusts by both inhalation and swallowing, during the period of a day or two preceding the collection of the sample. Therefore,

the samples must be collected after a working day, and not after a week-end or holiday. The urine samples will show the extent of the lead absorption of the individual and thereby will illustrate the severity of the exposure associated with his occupation.

Complete occupational histories on the selected men will have to be supplied to facilitate the interpretation of the results. The examination records on these men should also be supplied.

The analytical work will have to be done in this Laboratory, and the offer to do it is based on the belief that it is necessary for the proper carrying out of the program recommended herein. The work will be done at cost, since this is a non-profit organization, and an estimate of the probable cost can be arrived at by taking account of the fact that the actual cost of such work approximates $5.00 per sample analysed. The express charges on the shipment of containers and samples will be defrayed by the Johnson Bronze Company.

In connection with this analytical survey, it is suggested that blood smears on the men be made in duplicate by the Laboratory technician, he to examine one set and we another, so as to determine the extent to which agreement occurs. This can be arranged by means of direct correspondence between the laboratory and ourselves.

A report on this work with any additional recommendations that may be justified will be submitted.

Note: If it should not be feasible to carry out the procedure recommended above, it is possible that much the same information can be obtained by the collection of samples of blood and small samples of urine by Dr. Perry in the course of his physical examinations. The analyses of feces would be very useful but it can be dispensed with if necessary. The small samples of blood and urine are especially adapted to diagnostic work, while those recommended above are more useful for determining the exposure. The cost of the analytical work would be the same (per sample) regardless of the size and nature

of the sample, since the analytical manipulations and procedures are practically the same.

The primary purpose of determining the severity of the lead hazard is to find out how far it is necessary to go with respect to control measures and the frequency of the medical examinations. An additional advantage lies in the fact that such data will provide a base line by which to measure the effectiveness of the steps that are taken to reduce the lead exposure.

A series of samples of deposited dust have been requested in order to determine the significance and the distribution of the dust hazard. It is hoped that these can and will be obtained and forwarded before any significant changes can be affected. These samples consist of the following items: (1) Dust from top part of foundry near sand collecting and reclaiming equipment, (2) Rafter dust near men's wash-room, (3) Other samples (2 or 3) of rafter dust from identified locations, (4) Dust from the top of lockers in the men's wash-room, (5) Finely divided material from that which is taken to the metal washing room.

III. The third major recommendation has to do with the reduction of the present lead exposure in the foundry by eliminating the unnecessary ingestion (swallowing) of lead associated with the present lack of cleanliness on the part of the premises and the men.

(1) It is entirely necessary that change-room and locker-room facilities of satisfactory character be provided in a suitable location. There should be a double locker system, with lockers for the personal clothing of the men in a clean and uncontaminated part or room, with additional lockers for the work-clothes in a section or room that is certain to be somewhat contaminated by the men when coming from their

work. Shower baths should be so installed that men can go into them from the unclean side and emerge from them into the clean side, if this is possible. The so-called unclean side should be kept as clean as possible. Dusts should not be allowed to accummulate.

(2) Other sanitary facilities (toilets, and wash-basins for use before eating), should be so arranged that the "clean" locker-room will not be contaminated by men going and coming from their work.

(3) A lunch-room separate from the wash-rooms should be provided in such a location that it can readily be kept clean and free of dust and debris. Men must not be permitted to enter it without removing dust from their shoes and clothing and washing their hands and faces.

(4) Provision must be made for clothing for men who work in the foundry. All clothing is to be furnished on some mutually agreeable basis and provision is to be made for having work clothing laundered.

(5) Rules must be drawn up, posted, and enforced by supervision to the end that;

(a) All foundrymen change clothing before going to work and bathe and change before returning home;

(b) That all men wash their faces and hands and remove dust from their clothing and shoes before entering the lunch-room;

(c) That no food or beverage (other than that in drinking fountains) be kept or consumed in any of the work-rooms of the foundry, or in any other place than the lunch-room;

(d) That the chewing of tobacco during work hours be discontinued. (This rule is advisable but it may not be feasible to pro-

mulgate and enforce it without undue resentment. In lieu of such a rule men can be instructed how to handle their tobacco with such care as largely to prevent its contamination.)

(6) Good housekeeping can be carried out even in a foundry by attention to a few simple principles.

(a) All dusts that collect on roofs, rafters, window ledges and other flat surfaces should be cleaned up frequently, preferably by vacuum cleaners.

(b) All materials containing lead compounds can be kept in limited locations and disposed of before they dry out entirely. This applies chiefly to molding sand and debris, which can be spread about carelessly or kept cleaned up so as not to be picked up by air currents. Other materials should be kept in receptacles so far as possible, and when possible should be handled and transported in a moist state. Careful attention to details of this kind on the part of an intelligent and ingenious supervisor or safety engineer will eliminate much needless dissemination of dust.

(c) Rest rooms, locker-rooms and lunch-rooms must be kept entirely free of dusts, waste and debris.

IV. The fourth recommendation is a corollary to the third, in that continual supervision of men and critical examination of current practice is required to procure and maintain safety in hazardous occupations. A man responsible for safety, and for the promulgation of safe practices should be delegated to work with the physician and the management in promoting safe practices and in enforcing adherence to them. This job requires intelligence, tact, human understanding, patience, and persistence. It is best if he has authority but uses it sparingly. Accordingly the best results are

usually obtained by a technical man, with experience in and responsibility for production, who will be respected by the men for his knowledg and training. If he is agreeable and persuasive at the same time, his task will be easier. He should see that any regulations agreed upon as desirable and necessary are circulated, understood, and complied with. He should study the plant operations and their hazards and suggest means for improving the former and reducing the latter.

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