March 16, 1965

Mr. C. R. Willard, President
Willard Lead Products Company
101 New Bern Street
Charlotte 3, North Carolina

Dear Mr. Willard:

I have been trying to find time to write a memorandum to you on the conditions in your plant, and my recommendations concerning them, against a constant and growing number of demands on my time. As you are aware, no doubt, I have not succeeded. I have managed to write to your Dr. Mayer at the Nalle Clinic, and to send him certain published articles which bear in his problem.

I have come to the conclusion, today, that I should not delay longer in following up my visit with you with some specific recommendation, even if I have to make use of a second-best procedure for so doing. Accordingly I am sending a hurried modification of a report of this type which I prepared after a visit to a plant in which I encountered many similar (but by no means identical) problems. You will, I am sure, recognize the inapplicable parts of this report, and will appreciate those comments and criticisms which are pertinent.

I also send a copy of a booklet (a reprinted chapter in a text) in which the principles, and some of the practical procedures of industrial hygiene are described. I sent a copy of this to Dr. Mayer, but I think you should have one of your own.

I think I should supplement this memo with a few direct remarks that apply to your specific plant, as I noted them at the time of my visit.

(a) In the areas of forming lead products by extrusion, including the warehouse, there was little hazard from the actual work, day by day, but the floors were dirty and vehicles traversed them, thereby necessitating much better

housekeeping than is being provided - the floors should be repaired and rendered smooth where they are rough, and should be cleaned and kept clean by vacuum equipment.

(b) Area outside bag-house very dirty - lead oxide - should be cleaned thoroughly after each period of opening the doors to remove accumulated dust. This material now is being picked up by winds and carried around on feet of workmen and on any vehicle that traverses the area. Should be kept clean at all times, after opening and closing the doors.

(c) Flammable material is received and collected at back of smelter, put into cans without lids, and reintroduced into the cupula furnace. The contents are spilled about and tracked about, to add materially to the air-borne lead in the furnace area. Care must be taken, by means of tightly closed cans (lids) and proper handling, to prevent spillage. In this area a broom is used to gather up debris. This is an utterly inexcusable and highly effective means of dispersing dust in the atmosphere of this area. This man does not even wear a mask when doing his work. Not that he should do so if he were doing his work properly. If the latter were being done properly, he should not require a mask, but at present it is badly needed.

(d) The smelter area should be screened - or so it seems to this observer, to prevent the prevailing wind from carrying dust back into the area. The alternative is to clean up the entire area so there is nothing for the wind to carry. The latter, admittedly, is difficult to achieve. The only other alternative is to have everything wetted down.

(e) All sweeping with brooms is to be discontinued as soon as possible and vacuum cleaning is to be substituted, when floors and other dust collecting areas have been rendered smooth, and all objects in the way have been removed and placed in some proper orderly place.

(f) The facilities in this plant for washing, bathing, toilets and lockers are deplorable, so that personal hygiene could not be achieved, even if the plant housekeeping were to be greatly improved. Attention should be given to the provision of satisfactory, even attractive (not plushy but convenient and clean) facilities of this type, including a clean, comfortable place for storing lunch pails and eating.

In a space nearby, there should be a place for storing, cleaning, repairing and issuing respirators for use on such brief specific tasks as may require their use, this to be adequately staffed and supervised. Discipline, equivalent to that provided by an intelligent foreman, schooled in industrial hygiene, is necessary to achieve personal cleanliness and the proper use of protective equipment. Such goals have never been achieved in any industrial operations without persistent efforts of instruction, supervision, and the acceptance of full responsibility by the management for the care and use of respiratory protective equipment, and for the procedures of personal cleanliness.

Every man should be required - not requested but required - to change clothes and bathe at the end of the day or shift, and to change to work clothes at the beginning. Time must be provided (required by law) for changing clothes, and for bathing and changing clothes, at the beginning and end of the day or shift. For handling this properly, an arrangement of shower room and locker rooms should be provided whereby dirty clothing and clean clothing are separated, with intervening showers, so that the workman emerges into a clean area, puts on his clean clothing and terminates his exposure to dust (from shoes and clothing, when he departs for home).

With all of this information and these recommendations, you should be able to achieve a satisfactory result. I am fully aware that expense, and other difficulties are involved, but these have to be faced with as little compromise as possible. I hope you have been able to make some progress in this direction. Despite my delay, I am very anxious that my visit to you should have yielded useful results, and if I can assist you further, through correspondence, or through another visit by myself or one of the technical members of the staff. I am not attempting to urge our serves upon you, but I would not have you doubt our concern on your behalf and especially that of your employees. I am retiring from the headship of this Department and Laboratory as of the end of June, but there will be someone here after that time, if help is needed and desired.

I must say, with all appreciation of the difficulties of operating competitively in many of the lead trades, that the time is not far away when it will be mandatory to operate without hazard to employees. It is only prudent therefore, for the management of lead-using plants to achieve reasonable compliance with the requirements of the situation through their

own independent efforts, for those who lack such prudence will be put out of business by the very suddenness of the demands put upon them for compliance with the laws. This admittedly is an expensive business, so that one had better learn, stepwise, how to get along safely in it.

Sincerely yours,

Robert A. Kehoe, M.D.

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Enclosures

MEMORANDUM

On the Conditions Observed During a Visit to
Willard Lead Products Company, Charlotte, N.C.

The purpose of this memorandum is, first, to comment on certain physical conditions associated with the operation of this plant, in their relation to industrial hygiene, with special reference to the exposure of the employees to lead; second, to review, briefly, certain matters of procedure and policy in the handling of the operative personnel; and third, to make certain recommendations for the improvement of industrial hygiene, with respect to the control of the exposure of the employees to lead.

1. General Conditions in the Plant.

There are several features of the plant which create gross difficulties in matters of industrial hygiene.

(a) One factor is the limitation, as well as the unsatisfactory arrangement, of space. It is wise, so far as possible, to isolate operations which give rise to dust and fume from those which are not associated with a significant degree of contamination of the air. This applies also to the movement of materials and partially fabricated articles (those which spread lead-bearing dust around), whereby the wheels of vehicles of any type and the shoes and clothing of employees redisperse lead dusts on floors into the air. Lead-bearing materials and parts are stored in many areas of the plant, and

the floors are littered with dust. If more space were available it would be possible to rearrange storage and transport areas so as to confine the exposure to dust to those persons who must handle and transport partially finished parts of the batteries.

(b) The plant is over-crowded with equipment and materials in all stages of production from the smelter on through, the space being too little and, therefore, crowded and poorly arranged from the aspects of convenient handling and conveyance, and the achievement of cleanly housekeeping. In consequence persons are being subjected to exposure to lead dusts, because of the work and activities of others, when their own work, of itself, involves little necessary exposure.

(c) An additional problem, which militates against good housekeeping, is the condition of the floors generally, in most of the areas of the plant. These are rough, uneven and irregular as to surface, so that they defy adequate cleaning. In consequence of this factor, augmented by the shortage of space, there is a general state of uncleanliness. The housekeeping is very poor, and is likely to remain poor, in view of the difficulty, under the prevailing circumstances, of achieving good housekeeping. (Cleanliness in the lead trades is something very different from the degree of orderliness which is satisfactory in many industries. It is achieved only when lead-bearing dust on floors, moving objects, and surfaces that may be disturbed by moving people and objects and air currents, has been reduced to the point at which only very minute quantities are available for dispersion into the air of spaces in which people work. By

"minute quantities" one means a few milligrams, rather than visible, palpable quantities. This is why the housekeeping is said to be very poor, for almost anywhere in the operating areas of this plant, lead dust exists in sufficient quantities to be seen readily, and in some it can be shoveled up. One cannot guess at the concentrations in the air in various parts of the plant, but the impression developed at the time of the visit was that in some areas - the smelter being the worst - the atmospheric contamination must be excessive. In others, at least intermittently, it must often be dangerously high.)

(d) A third problem, somewhat related to those mentioned previously, is the difficulty of providing suitable drainage (floor drains, ditches, etc.,) in and from the operating areas by which water, used to hose out dust and debris from floors and other accessible surfaces, can be collected into a settling basin and freed (sufficiently) of lead before entering drains which lead directly (or perhaps indirectly) to a local stream (or streams). It does not appear that there is space enough to enable local drains to be used and controlled (as to their output of lead).

(e) The problem of stack effluents may or may not be significant. It appeared, at one time during the day, that there was a considerable quantity of effluent; at other times it appeared to be nearly negligible. If there is an intermittent escape of lead compounds in significant quantity from this source, some further effort will need to be directed toward this end. Our primary concern, however, is for the safety of the workmen

in the plant, and although the cultivation of good relations in the neighborhood is important, the workmen are subjected to greater risk than the neighbors, and they are entitled to the first consideration.

2. Specific Areas and Conditions.

(a) The yard around the smelter in which broken batteries are stored and handled, and transported, along with other lead-containing materials, to the furnaces, is potentially dangerous. It appeared, at the time of this visit, that there was sufficient moisture in the materials and all over this area to prevent the dispersion of dust into the air. There is no assurance, however, that this is always the case, and if it is not, this situation is dangerous. In a similar situation, involving dry material, we found that every man who had worked for as long as three weeks, had absorbed dangerous quantities of lead. Lead-containing materials in this area of the premises were distributed over the entire area of these activities in very generous quantities. Only a limited amount of superficial drying of some parts of the general area would be sufficient to create a gross hazard.

(b) Conditions within the smelter on the day of this visit were almost as bad as any that can be imagined in lead trades in which dust and fume are to be dealt with. The fume in the air was distributed largely (but not exclusively) within the upper part of the smelter building, where no one was working (one man went into this area to open up a partially plugged duct and remained there only for a short time). It can safely be assumed, however, that the point at which the visitor stood

to view the operations, was surrounded by air too heavily contaminated with dust and fume to be safe for regular occupancy. There was no part of the smelter, on this day, in which it was safe for men to work regularly. Some of the men wore dust respirators. One had his respirator around his neck. Others had no respirators with them at this time, despite the existence of unusually bad conditions. It is evident that the use of respirators is a matter of judgment or choice on the part of the workmen. It is just as evident that, under the conditions that existed in the smelter on this day, every man should have been using his respirator continuously. The men, clearly, had no fear of the situation in which they were working. This means, simply and certainly, that they had no real understanding of the significance of the exposure to lead to which they were being subjected. This observer will be surprised if there is a single man in this group who has not absorbed potentially dangerous quantities of lead. If there is such a man in the group, then the conditions observed at the time of this visit were unusual, or else such a man has been working in the smelter irregularly or for only a short time.

To cap the climax, as to conditions in the smelter, dry sweeping was being done in an effort to gather up the material skimmed from pots and the finely divided, dry, lead oxide. Reference will be made to this procedure later. No other effort appears to be made systematically to keep them clean, and thus they are a source of widespread contamination. Emphasis is put on this, possibly beyond its significance as a lone factor,

for the reason that the movement of people, equipment and materials through the plant is an important series of sources of contamination of the air. The floors over which vehicles move, the vehicles themselves, and everything they carry, should always be free of dust-producing materials. These items can be vacuum-cleaned frequently and kept clean. After they have moved unclean materials, they should be cleaned thoroughly, so as not to perpetuate the distribution of debris. However, so long as dusty objects and dust-producing materials are being moved about, the floors over which the movement takes place will be contaminated. Such floors (in areas of traffic) should be kept smooth, free of pits, ridges, gratings and the like, and should be thoroughly vacuum-swept with sufficient frequency to maintain their cleanliness. The only alternative - which is often an unsatisfactory one, for several reasons - is that of keeping the floors wet, so as to prevent the raising of dust. Vacuum cleaning is preferable, but is, we believe, impossible, unless floors are smooth, regular and as free as possible of objects that get in the way of vacuum sweeping, having corners and crevices in which dust gathers.

(c) The wash rooms, lunch room, shower rooms and locker rooms were unsatisfactory, and they are not being used by a well informed and well supervised plant population. The sight of employees eating and drinking, without a disciplined washing up, beforehand, was fairly convincing evidence that they have little idea of the ways of cleanliness in connection with their work - that is, of the precise nature of the cleanliness required and how to achieve it.

3. Matters of Procedure and Policy in Industrial Hygiene.

It can hardly be said that there is a program of industrial hygiene in this plant, in the technical or professional meaning of the term. A feeble attempt in that direction is being made on the recommendation of some person or persons - obviously inexperienced - connected with the insurer (or insurers) of the industry.

Industrial hygiene, in the lead trades, insofar as it is sought and achieved in its non-medical aspects, is comprised of a series of technical procedures, whereby exposure to lead is measured and brought under adequate control. It consists, first, of the design of operations so as to limit the contamination of the air of work-rooms, and the arrangement of space, so as to separate potentially hazardous from non-hazardous operations. It then measures the respiratory hazard by adequate sampling and analyses of the air at the breathing zone of the operators of various processes, and on this basis appraises the need for measures of control. It continues further in bringing the necessary degree of control into the hazardous or potentially hazardous operations. Such control relates to the design of equipment, the ventilation of equipment that requires ventilation (primarily by exhaust ventilation of specific areas or operations which give rise to dust or fume), and the collection of exhausted material where it will not return to the air. (The adequacy of the measures of control is checked by further analysis of the air.) It goes still further, in developing methods of housekeeping which prevent the accumulation

of materials that can raise dust, and which gather up such materials by means which do not, of themselves, create dust.

Industrial hygiene as applied to industrial personnel, is directed first to the instruction of such personnel in the potential dangers of their work, so that they will understand why they are required to do certain things and not to do certain others.

The first lesson relates to care in not raising dust. (Dry sweeping, of course, flies in the face of this, and defeats every other effort to achieve understanding of this matter.) Such attention as is required is devoted to the proper use of respirators, air-line masks, or whatever is best and necessary, in dealing with irregularly recurring conditions in which, from time to time, the air where one must work is badly contaminated and must not be breathed or must be cleaned before being breathed. Proper masks must be selected by the management (or those who know best), and must be kept in proper condition for prompt use, and their use must be enforced by adequate intelligent but insistent, supervision. (It is not satisfactory to depend upon the use of respirators regularly or constantly, for the avoidance of exposure to lead dust or fume. The basic conditions under which men work should be safe. There are, however, situations which may recur from time to time, through faulty equipment or operations, or in connection with occasional operations or processes, which require respiratory protection. These should be subject to firm supervisory instruction, so as never to be ignored.)

Next in importance comes the training of the personnel in the avoidance of the ingestion of lead. This calls for excellent facilities for storing work and street clothing (double lockers), comfortable and cleanly showers which will invite usage, suitable hand (and face) washing facilities, spotlessly clean and dust-free rooms in which all eating is done, and clean and sanitary toilets. Unless these are orderly, clean, and reasonably attractive they will not be used freely by men and women, so that training and discipline will fail.

All employees should be instructed in attention to the details of cleanliness - bathing and changing clothes at the end of the shift; washing up carefully before eating; eating and drinking only in specially provided and designated places. (Men were seen to be smoking. Some of them in all likelihood, chew tobacco. This should probably not be permitted, for it is only by the exercise of unusual care that this can be done without taking lead into the mouth. In any case, if it is permitted, the men (and women) should be shown how to avoid the ingestion of lead. They must come to an understanding of the fact that the swallowing of lead, in connection with their work, must be prevented, and that this can be done only through their own care.) No food or drink should be kept anywhere in the plant except in designated storage areas and facilities. Such facilities must be so designed, located and maintained as to be free of dust at all times.

There should be a satisfactory regimen of medical supervision of all operating personnel. This is comprised of

suitable medical examinations, suitable clinical laboratory procedures for investigating the health of employees, and satisfactory analytical facilities for checking the lead content of blood or urine (or both) at suitable intervals as determined by medical and economic policies of the plant, (such facilities need not be in the plant, but should be accessible by pre-arrangement and not too remote for prompt service), and opportunity for inspection of the plant and for instructing the employees in matters of hygiene. The details of the medical regimen cannot be - and need not be - described here.

The establishment of a satisfactory medical and hygienic regimen will necessitate provisions for a suitable medical facility in the plant. The present quarters are wholly inadequate for this purpose.

From The Kettering Laboratory in the Department of Preventive Medicine and Industrial Health, College of Medicine, University of Cincinnati, Cincinnati, Ohio.

Robert A. Kehoe, M.D.
Director

Date: March 16, 1965