B149 (112) Perlite

PERLITE

November 23, 1970

F. B. Hutto - Johns-Manville
F. M. Coda - Perlite Institute

HEALTH STUDY QUESTIONNAIRE
AND COVER LETTER

Both the Health Study questionnaire and the cover letter drafts appear to be appropriate for the purpose.

I suggest they be sent out.

Very truly yours,

C. L. Sheckler
Manager, Accident Prevention
and Health Administration

PERLITE INSTITUTE INC.
45 West 45th Street / New York, N.Y. 10036 212 · 265-2145

November 18, 1970

Mr. Francis B. Hutto, Jr.
Johns-Manville Products Corporation
Research & Engineering Center
P. O. Box 159
Manville, N. J. 08835

Dear Francis:

Enclosed is a draft of the letter and questionnaire discussed at Cliff Sheckler's office on November 17.

Please review and let me have your comments before sending to counsel for final approval.

Best regards.

Sincerely,

PERLITE INSTITUTE, INC.

Frank M. Coda
Managing Director

FMC:rm

Enclosures

cc: C. L. Sheckler

MTC 013910

DRAFT

Gentlemen:

Due to the increased awareness and concern regarding environmental health the Health and Safety Committee of Perlite Institute, Inc. has been requested to investigate the industries' interest in a health research study.

This study would involve a review and analysis by a noted medical authority of available chest x-rays of employees with not less than 5 years of exposure to perlite dust in an in-plant environment. It is believed that such information evaluated in a statistical manner will be of great practical value.

The purpose of this letter is to accertain your interest in this proposed project and willingness to participate by contributing available employee x-rays. In this regard we would sincerely appreciate your completing the enclosed questionnaire and returning it to Perlite Institute by 1970.

In order that the results of such a project will be representative of our entire industry we are encouraging both member and non-member firms to participate.

The cost of this project will be pro-rated amongst participating companies. However, the share of the cost pro-rated between Institute members will be borne by the Institute as a part of our

continuing service to member companies.

Your consideration in this matter is appreciated and let us hear from you soon.

Very truly yours,

Francis B. Hutto, Jr.
Chairman
Health and Safety Committee

DRAFT

Return to: Perlite Institute, Inc.
45 West 45th Street
New York, N. Y. 10036

Re: Proposed Health Research Study
Chest x-rays

Gentlemen:

We acknowledge receipt of your letter of
with regard to the referenced subject.

We ☐ would like to participate in the proposed project and can supply x-rays of _____ employees.

☐ are unable to participate in the referenced project.

_____
Representative - Title

_____
Company

_____
Date

MTC 013913

Members

J.M.
Grefco
Zonolite (Grace)
Redco

Non-Members

U S Perlite - Ill.
Scott Lite Prodts - Calif.
Pamrod - Texas
Pabca - Calif.
Federal Cement & Tile - Lond.
C.E Refractories - Penna
Blue Diamond - Calif.
Midwest Perlite Corp
Liteweight Prodts - Kansas
A & W Bldg. Supply - Fla.

Non-Members

Am. Perlite
Silbrica (Unipearl Div) United
* U.S.G.
Calumate Mining
Oneida Perlite
Armstrong Cork
Best Wall
Chemrock
Coralux
Nat. Gyp.
Penna. Perlite - Allentown
Sil - Flo
Paramount Perlite - Calif.
Harbor Lite Corp - Calif.
Celetex
Panacon (Phelps Carey)
Perlite Processing - Calif.
Perlite Popped Prodts - Calif.
Perlite Aggregates - Calif.
Metro Minerals - Calif.
Filter Materials Corp - Ill.
Whitemore Prodts - Mass.
Supremo Perlite - Arizona
Kaiser Gypsum

MTC 013914

Memo

Date_____

To:_____

cc:_____

SUBJECT: Perlite module

Call IHF re: meeting w/ Perlite S+H Comm.

Tent. Dates 4/15-16-20-21-22

Call F. Hutto when dates are established.

IHF 8-84-717-9 412-687-2100

SIGNED_____ LOCATION_____

Form 3-2C Printed in U.S.A

WHY FILE THIS!

Memo

Date _____

To: _____

cc: _____

_____

SUBJECT: _____

SIGNED _____ LOCATION _____

Form 3–2C Printed in U.S.A.

WHY FILE THIS!

MTC 013916

CLS Copy

SARANAC REPORTS ATTACHED

April 3, 1970

Dr. T. P. deTreville, President
Industrial Hygiene Foundation of America
5231 Centre Avenue
Pittsburgh, Penna. 15232

Dear Dr. deTreville:

Confirming our recent phone conversation, the Perlite Health and Safety Committee will meet with you and Dr. Gross at the Industrial Hygiene Foundation of America office, 5231 Centre Avenue, Pittsburgh, Penna. at 11 A.M., Tuesday, April 21st. The purpose of this meeting is to discuss with you the medical scientific work done in conjunction with Perlite. Also, your opinion of what further work should be done, if any.

I anticipate there will be four or five representatives from various Perlite mining and manufacturing companies.

As requested by you, enclosed please find copies of three reports:

- Perlite Dust Investigation by The Saranac Laboratory, November, 1953
- The Biotoxicity of Perlite by Dr. Schepers, March 19, 1955
- The Biotoxicity of Perlite by Dr. Pratt, June 5, 1959

You indicated that Dr. Gross would review these reports prior to our meeting.

Thank you for your kind cooperation, and my best personal regards to you and Dr. Gross.

Sincerely yours,

C. L. Sheckler
Manager, Accident Prevention
and Health Administration

CLS:mw
Encl.

cc: P. A. Martinson, President - Perlite Institute, Inc.
F. M. Coda, Managing Director - Perlite Institute, Inc.
F. B. Hutto, Chairman - Health & Safety Committee, Perlite Institute, Inc.

inhalation experiments with nine samples would involve unwarranted expenditures if the results of the intratracheal experiments proved the similarity noted in the Petrographic and X-ray diffraction studies. This similarity was proved and the inhalation experiments were conducted with the sample identified as MD 201. A brief summary of the essential character of this material is as follows:

"A glass, with a few anisotropic inclusions and with traces of quartz and feldspar."

A. Following the Petrographic and X-ray diffraction studies, screening tests of the various samples received, were carried on to determine the median particle size of that portion of dust which passed through the 200 mesh sieve and the percentage by weight of the samples passed through the sieve was also measured. The quartz content of the 200 mesh fraction of each sample was then determined by X-ray diffraction.

II. INTRATRACHEAL EXPERIMENTS

A. In order to carry on the intratracheal injection experiments, it was necessary to grind all of the 200 mesh material down to 5 microns and less in size. This procedure was carried on separately for each sample. For intratracheal injection a sample of each dust is suspended in a saline solution. A long blunt needle is then passed through the mouth, larynx and trachea of the animal so that the tip of the needle is located in the left main bronchus. The material is then injected through the needle and is followed with a small quantity of air in order to make sure that all of the suspension is expelled from the needle. This is an accepted method of obtaining relatively fast reactions to a foreign material in a lung and is the usual primary phase of experimental work to determine the necessity for inhalation experiments which, of course, take a long time and, therefore,

MTC 013918

are costly. The tissue reactions observed in the various experiments carried out by intratracheal injection of nine (9) Perlite products in gunlea pigs revealed that none of the products tested incited more than a slight degree of irritation at any of the observation intervals which were from 4 to 12 months after the injection of the dust.

III. INHALATION EXPERIMENT

A. The inhalation experiment with normal animals, as has been noted above, was carried on by subjecting normal guinea pigs and rats to an atmospheric suspension of one of the Perlite products, namely, MD 201. The guinea pigs and rats were exposed to this atmosphere for a period of 8 hours daily, 5½ days per week for a total of 18 months. The results, after prolonged inhalation of Perlite dust, confirmed the observations derived by intratracheal injection, namely, that the inhaled dust of the representative Perlite product fails to produce a significant inflamatory reaction in the lungs of healthy uninfected guinea pigs and rats. It appears highly doubtful this would change in the future and it is felt that the conclusions would only increase in significance if the duration of exposure was prolonged beyond the present interval of 18 months.

IV. OBSERVATIONS AND SUMMARY

A. On the basis of the observations made to date and with considerable confidence that the nature of the reactions will remain as they are at present, it would appear as far as industrial workers with normal lungs are concerned, contamination of the atmosphere of an industrial plant by Perlite may be considered as merely a nuisance. On this basis and in

accordance with generally accepted practices, the allowable dust concentration in Perlite operations might be set at a level of the order of 50 million particles per cubic foot of air.

B. The report submitted by the Saranac Laboratory can, therefore, be summarized as follows:

(1) Thirteen Perlite products submitted to the Saranac Laboratory have been studied for composition and size distribution of particles. Nine of them have been tested for biological activity by intratracheal injection in guinea pigs, and one has been studied in a comprehensive inhalation experiment.

(2) All products submitted are relatively coarse, and consist chiefly of glass, accompanied by a small amount of quartz.

(3) Each of the nine products studied by intratracheal injection yielded a type of reaction classified as inert.

(4) The products studied by inhalation also yielded an inert type of reaction in the lungs of normal guinea pigs and rats.

When conducting investigations to determine whether a dust is capable of affecting the respiratory system to a degree which will result in disability it is essential all phases of possible involvement be studied. Investigations, therefore, using animals with a lung infection (usually tuberculosis) must be carried on in addition to research with animals which have a normal or uninfected respiratory system. To eliminate this phase of the study would result in an incomplete research project because all men exposed to dust are not free from respiratory infection. Further, certain dusts are known to cause men to be more susceptible to infection such as tuberculosis and to

accelerate infection when it occurs during exposure. In order to further determine the ability of Perlite dust to cause disability, the Saranac Laboratory has conducted investigations using animals infected with tuberculosis. We have received a progress report describing the relation of Perlite to an associated tuberculosis infection but the investigation has not been completed and further studies are required before conclusions can be presented concerning this phase of the study. The information contained in the outline set out below is, therefore, a series of observations made to describe the progress of the Saranac research now being conducted with infected animals.

I. MATERIALS

A. The present inhalation experiment relative to the influence of dust upon tuberculous infection is being performed with the identical Perlite product (MD 201) with which the inhalation experiment involving normal animals was conducted.

II. INFECTION

A. For the purpose of this experiment a strain of the tubercle bacilli known as R_I is used. These organisms produce in normal guinea pigs a tuberculous infection which develops and progresses for about 2 months and subsequently, over a period of many months, regresses and heals. When infected animals are exposed by inhalation to certain dusts, of which the classical example is quartz dust, the tuberculous infection progresses continuously over a period of many months and ultimately causes the death of the animals. Saranac elected to use animals infected with R_I tubercle bacilli to conduct the Perlite studies because on a variety of toxic and

non-toxic dusts a dependable consistency of results previously had been produced.

III. METHODS

A. We will not discuss the technique of conducting inhalation experiments with infected animals because it is essentially the same as that described in the final report relative to the effect of Perlite dust on animals with normal lungs.

B. The study of the influence of Perlite dust upon associated tuberculous infection is being carried out in 3 phases which are as follows:

(1) The exposure of animals to the dust by inhalation is started immediately after they have been infected with tubercle bacilli.

(2) The exposure of groups of animals to the dust is started 2, 4 and 6 months after infection.

(3) Animals are exposed to the dust for 4 months; they are then infected, and their exposure to the dust is continued.

IV. OBSERVATIONS

A. A number of the animals sacrificed to date have, upon examination, demonstrated progressive tuberculosis and some of them have died of tuberculosis. The phenomenon of a dust which is essentially inert for normal tissue causing progression of tuberculous disease in animals is unprecedented and the Saranac Laboratory is continuing their research because in their opinion there are several reasons to question the validity of this

finding. Experiments of the type which are being carried out with Perlite dust are essentially research projects and unusual findings cannot be predicted in advance. This unprecedented reaction is in the class of "unusual findings" and can only be dismissed or validated by continued research.

B. In view of the above observations, however, it is prudent to suggest a somewhat lower limit of permissible dust concentration than 50 million particles per cubic foot. A tentative maximum allowable concentration should be established at not more than 15 to 20 million particles per cubic foot of air.

C. It must be understood all observations contained herein are based on a progress report and, therefore, can only be considered as interim findings. When the additional research conducted by the Saranac Laboratory has been completed then, and only then, can the final results of the experiments to determine the influence of inhaled Perlite dust upon the course of pulmonary tuberculosis in animals be determined.

PART I

PERLITE DUST INVESTIGATION

The Saranac Laboratory
Of The
Trudeau Foundation
Saranac Lake, New York

Prefacing Remarks to Members by Donald R. Tellefsen

As you know, the Perlite Institute has sponsored an investigation by the Saranac Laboratory to determine the effect of inahled Perlite dust upon the lungs of animals. This investigation was undertaken because we, in this industry, wanted to know if men exposed to Perlite dust would experience lung changes which might be disabling.

A description of the findings of the laboratory furnished in interim reports and discussions has been presented to the members at our various meetings together with suggestions for dust control and health improvement programs.

We have now received a final report describing the effect of inhaling Perlite dust upon the lungs of normal animals.

Set forth below is an outline of the information contained in this report:

I. MATERIALS

A total of thirteen (13) different samples of industrial products prepared from Perlite were submitted for study. Nine (9) of the samples received were studies by intratracheal methods and one of the samples identified by the laboratory as MD 201 was used in the inhalation experiment. All samples, however, were studied by Petrographic and X-ray diffraction procedures. From such studies it was learned the similarity between the various products was such that nine could be used for intratracheal studies and one for the inhalation experiments. It was further decided that to conduct

PART II

PERLITE DUST INVESTIGATION

SUGGESTED DUST CONTROL AND HEALTH IMPROVEMENTS PROCEDURES

It is difficult to generalize on any subject affecting the operation of a plant or the activities of its employees but particularly so when the plants are faced with a common problem and have various methods of processing as well as unrelated plant layouts and numbers of employees. We will, however, suggest certain methods of dust control, personnel policies and procedures which are sufficiently flexible so they can be used in whole or in part by member companies.

I. SUGGESTED EMPLOYEE EDUCATIONAL AND HEALTH IMPROVEMENT PROGRAM

A. Pre-Employment Interview.

(1) Employment History.

(a) It is important prospective employees furnish the interviewer with a complete work history because it would be imprudent to accept an applicant who had worked in an industry where he was exposed to an occupational disease which could have affected his respiratory system. Prior employment in an industry where an employee has been exposed to dust known to be harmful should disqualify the applicant. Examples of such industries are:

(i) Mining

(ii) Foundry

(iii) Pottery or Brick Manufacturing

(iv) Chromate

(v) Beryllium

(2) Primary Education.

(a) You might explain to the applicant that industry has for many years followed the principles and policies of safety programs and procedures and this, a modern company in a new industry, has established a safety program as a part of its basic operating policy. If the applicant becomes an employee he must understand the safety program was designed to protect his health and physical well-being and as an employee he will be expected to respect all safety policies, procedures and regulations. A brief explanation of the following will be helpful:

(i) General safety practices in the handling of materials, machinery, etc.

(ii) The necessity for wearing a respirator to protect against inhalation of dust.

(iii) Wearing safety goggles, shoes, gloves, etc.

(iv) Proper lifting, carrying, pushing, etc. methods.

(v) Hazards associated with specific plant or job.

B. Pre-Employment Physical Examination, Including Chest X-ray.

(1) Applicant should not be employed until an interpretation of his chest X-ray has proved the absence of lung change or infection.

(2) Applicant should not be employed until the results of his physical examination have proved he is physically capable of performing the activities to which he will be assigned.

C. Indoctrination.

(1) Detailed explanation of the hazards to which the employee will be exposed (following the outline suggested under A. 2. a).

(2) Complete explanation of your respirator program.

(a) Provide a respirator, approved by the U. S. Bureau of Mines for use in pneumoconiosis producing dusts, explain the proper method of wearing and instruct the employee to use the respirator whenever he is in an area where dust counts have proven to be in excess of 15,000,000 particles per cubic foot (tentative maximum concentration) or where dust is visible due to a failure of dust control.

(b) It has been found necessary in certain companies to establish a penalty program as a means of enforcing the wearing of respirators. For example, the first time an employee violates your respirator rules he is warned, the second time he is laid-off without pay for three (3) days, the third time he is laid-off for a week without pay or discharged.

D. Employment.

(1) All employees should have annual physical examinations including a chest X-ray. The doctor's interpretations should be discussed with the employee and, if significant chest changes are noted, the employee should be encouraged to seek employment elsewhere or be transferred to a job where he will not be exposed to dust.

E. Terminated Employees.

(1) It is advisable to have a termination chest X-ray interpreted before an employee receives his final check. If this procedure is followed you have some assurance the employee will not, at a later date, submit a claim to you if he experiences chest changes resulting from another cause.

F. Personnel Records.

(1) Company personnel files must be maintained and should include:

(a) Past record of employment, the type of job held and the time employed on each job.

(b) Jobs held during his employment with your company and the period he worked on each job.

II. DUST CONTROL

A. Periodic dust counts, minimum of one (1) each month in each area where there is an exposure.

(1) Complete records should be maintained describing the area, the dust count, and the operating conditions at the time the count was taken.

(2) The dust counts should then be examined and action should be taken to reduce the count below 15,000,000 particles per cubic foot.

(3) We suggest the following as possible dust control measures:

(i) All pneumatic carrying systems should be on a negative rather than a positive basis.

(ii) Vacuum pick-ups should be installed over bagging equipment and any other point in the operations where dust can be emitted into the atmosphere.

(iii) Employees should be instructed to so handle the material that a minimum of dust will be created.

(iv) Care should be taken to make certain dust does not accumulate on the bags.

(v) All equipment should be policed and leaks sealed immediately.

(vi) Provision should be made for prompt removal of dust caused by leaks, spillage, etc. and also for periodic removal of accumulated external dust by such equipment as vacuum pickup lines or vacuum units.

B. Preventive Maintainance.

(1) Your company should establish an aggressive housekeeping program which will include prompt repairs to system leaks to prevent general contamination and emergency plant shut-down for repairs of major leaks.

C. Management, Supervision and Labor.

(1) Periodic meetings of management and supervision should be held for discussion of safety and health improvement programs.

(a) During the meeting, management's policy with respect to safety and health improvement programs should be presented together with the following:

(i) The success or failure of engineering and employee education programs.

(ii) Constructive criticism for failure to aggressively pursue the objectives established.

(iii) Minutes of the meetings should be distributed not only to management but supervision as well.

III. ACCIDENT PREVENTION PROGRAM

A. A Safety Committee with the Plant Superintendent as permanent Chairman and a rotating membership consisting of representatives from Supervision and plant employees.

B. Monthly plant inspection by a Committee representing Supervision and plant employees.

C. Weekly plant inspection by an inspector appointed by Safety Committee.

D. All lost time or medical accidents to be investigated by Supervisor of Department, with report showing cause, suggested remedy and action taken.

E. First Aid records to be maintained showing names, dates, types of injury, cause.

F. Safety Committee to meet monthly.

(1) Review monthly and weekly inspection reports to develop recommendations to Management on conditions reported and which Plant Superintendent has been unable to correct. Also, to review conditions which Superintendent has corrected prior to the meeting for any suggestions which might improve the correction. To review latest dust counts and endeavor to develop suggestions for improvement at high count areas.

(2) Review accident investigations reports for remedy suggested by the Supervisor and adequacy of action taken.

(3) To review any safety suggestions made by fellow employees or any conditions or work practices noted by themselves.

(4) Review First Aid reports for repeaters (employees frequently requiring First Aid) and for frequency of any types of injury

causes. To develop corrective recommendations on either of these conditions.

(5) Develop and maintain safety education media as: posters, notices, group meetings for particular purposes as reporting for first aid on minor injuries, handling materials, use of personal protective equipment, etc.

G. Superintendent of each plant to act as Safety Director and see that above activities are properly performed. Also, to promptly receive inspection reports, dust counts and accident investigation reports and to immediately initiate any corrective action within his power and to follow through on completion of same. Superintendent, as Chairman of Safety Committee, should also guide the recommendations of the Committee to Management on any conditions beyond his power to immediately correct.

THE BIOTOXICITY OF PERLITE

A review of certain animal experiments and a critique of the report from the Saranac Laboratory concerning them.

Philip C. Pratt, M.D.
Assistant Professor of Pathology
Ohio State University
College of Medicine
466 West 10th Avenue
Columbus 10, Ohio

June 5, 1959

MTC 013932

The Biotoxicity of Perlite

A review of certain experiments and a critique of the report from the Saranac Laboratory concerning them.

INTRODUCTION

This review of certain animal experiments with Perlite dust conducted at the Saranac Laboratory in Saranac Lake, New York, and of the report of these experiments has been conducted at the request of the members of the Perlite Institute. That report is titled "The Biotoxicity of Perlite" and is dated March 19, 1955. The review has been directed primarily at an evaluation of the results of an experiment designed to reveal the course of R_1 tuberculous lesions during the months after cessation of exposure of the experimental animals to Perlite dust. This reviewer was the originator of this particular experiment which had two major purposes as follows:

First, in preceding experiments which had revealed the capacity of Perlite dust to stimulate R_1 tuberculosis in guinea pigs, there were certain peculiarities which suggested that the mechanism of this phenomenon might be related to excessive accumulation of dust in the lungs during the period of exposure of animals with active infection. Since any Perlite worker who might develop tuberculosis would presumably be promptly removed from exposure for treatment it seemed that such excess accumulation if it were of importance in the experimental situation would not occur in industrial experience. Secondly, it was clear that Perlite dust was much less powerful than quartz in its stimulatory action upon tuberculosis in guinea pigs and it was suspected that even if the above theory might be incorrect still the progressive character of the disease might not persist after interruption of exposure.

MTC 013933

The key animal groups in this experiment were, therefore, first the group infected with R_1 organisms at the beginning of a six month period of exposure to Perlite dust and second, the one infected at the end of the exposure. The lungs of sacrificed animals were analyzed for silica to ascertain whether or not excess dust did accumulate in the lungs of infected animals exposed to dust as compared to noninfected controls.

METHODS

For purposes of this review it has been necessary to prepare new slides of the large lung sections of all animals in this special experiment which has the Saranac Laboratory number 1233. This reviewer has examined all of the 88 slides and has reported his observations in Tables 1 and 2 which can be compared with Tables 3 and 4 of the final report from the Saranac Laboratory to the Perlite Institute dated March 19, 1955. The code used by the writer of that report is used here with the symbols for extent of involvement having the following significance:

0 = none seen. Thus if a lung is interpreted as S-0, F-0 this would mean that no tuberculous lesion of any type was found in the lung.

1 = a few isolated foci of tuberculous involvement which may appear to be progressing, P; stabilizing, S; or fibrosing, F.

2 = an area of involvement representing more than "1", but less than one quarter of the total lung area.

MTC 013934

3 = an area of involvement representing from one quarter to three quarters of the total lung area.

4 = an area of involvement representing more than three quarters of the total lung area.

OBSERVATIONS

Examination of Tables 1 and 2 and comparison with Tables 3 and 4 in the final report already identified, will reveal only relatively minor differences in the readings of the slides. Of the differences the most significant is that none of the dusted animals were considered to show stabilizing disease in the previous report while this reviewer interprets the lesions in the late stages of Group A (6-12 months in normal air) as stabilizing. Similarly the lesions in Group B from 4 to 12 months after infection appear to be stabilizing rather than progressing.

DISCUSSION

The author of the previous report concerning the results of this experiment correctly mentions on page 6 in paragraph 3 of his discussion the possibility that "the course of events in R_1 infected guinea pigs does not necessarily indicate precisely what is to occur in industrial workers exposed to Perlite dust who may develop tuberculosis." He also correctly points out that previous experience has shown rather good correlation between the effect of various dusts on R_1 tuberculosis in guinea pigs and industrial experience. This reviewer agrees that the experimental results, correlating well with those of the earlier Perlite experiment, strongly suggest that excessive exposure to Perlite dust may

very likely have the effect of stimulating tuberculous infection in man. However, the important finding in the study being reviewed here is that the stimulatory action is clearly temporary and that any disease which may occur in industrial workers can be expected to respond well to treatment and once stabilized will tend to remain so. This may be contrasted with the situation in the case of silicosis where the stimulatory effect persists indefinitely even after cessation of exposure both in animals and in man. Thus the outlook for any worker who might develop tuberculosis while in exposure to Perlite would be much more favorable than for a person with silicosis.

Despite his cautionary statement quoted above, the author of the previous report places great stress upon the fibrotic character of the healing lesions in the experimental animals and apparently assumes that extensive fibrosis will be the consequence of any tuberculosis which may occur in industrial workers. For example, in the first paragraph on page 9 he states "the residual fibrosis in the lungs may in itself be a crippling disease" and "may be compared with that found in association with advanced silicosis." In this reviewer's opinion this is a highly unjustified extrapolation from the experimental results. Thus it is clear from the experiment that the residual fibrosis is present only in sites where tuberculous lesions had existed and there is nothing to suggest that the dust per se becomes fibrogenic in the infected lung. Therefore the residual fibrosis is extensive in the animals only because the infection was allowed to become extensive under the conditions of the experiment. There is no reason why any tuberculous infection in workers should become so extensive, because even if the workers do not

have annual chest x-rays, which they should in any industry, any man would be recognizably ill long before his disease reached anything like the extent present in these animals. For this reason, the great stress placed upon residual fibrosis in the previous report is patently unwarranted. While one may philosophize about the extrapolation of findings in experimental animals to man, even when previous work has revealed good correlation, one should exert great care in identifying those aspects of any experiment which cannot possibly be reproduced in the human situation.

In passing it may be mentioned that the experimental results completely refute this reviewer's theory which the study was designed to test. If the stimulatory effect of Perlite were the result of excess retention of dust in the lungs of infected animals, the experiment should have shown progressive disease in Group A but not in Group B since the latter animals would have had no opportunity to accumulate excess dust. The mechanism of the effect therefore still remains obscure.

Mention should finally be made of the highly fanciful graphic representation of the predicted effect of Perlite dust upon tuberculous infection in man as depicted in Figure 14 of the final report already identified. The implication of this graph is that one month in the life of a guinea pig is equivalent to one year of human life. There is no shred of evidence known to the writer upon which this conclusion can be based. In fact it is patently erroneous since the average life-time of a guinea pig is only about 36 months. The resultant implication that tuberculosis in a normal man runs a natural course of some 12 years and would last 18 years in a person having Perlite exposure is absurd.

There are other points in the report under review which are open to similar criticism, especially in the section concerned with further suggested research, but it does not seem desirable to lengthen this review in order to cover them all. The essential point is that while there is experimental evidence to indicate that heavy exposure to Perlite dust may predispose industrial workers to tuberculous infection, the risk involved is far less than that with quartz dust and the effect is only temporary rather than indefinitely prolonged as is the case with quartz.

With regard to permissible dust concentrations for prolonged exposure it still appears to this reviewer, as he has stated in the past, that Perlite dust exposure should be considered somewhat more serious than a mere nuisance. If 50 million particles per cubic foot is acceptable as a reasonable maximal concentration for nuisance dusts one might suggest a somewhat lesser concentration, say 30 million, for Perlite.

SUMMARY

1. The microscopic slides and the final report concerning an experiment with Perlite dust have been reviewed.

2. This reviewer's observations are generally similar to those reported with the exception that stabilization of lesions in dusted experimental animals is recognized earlier and more consistently.

3. The direct extrapolation to man of the observed terminal fibrosis in guinea pigs is shown to be unjustified.

4. The overall risk of exposure of industrial personnel to Perlite dust is believed to be much less than is implied in the final report entitled "The Biotoxicity of Perlite" dated March 19, 1955.

Table 1

COURSE OF R_1 TUBERCULOSIS IN GUINEA PIGS
EXPOSED TO PERLITE DUST AND IN UNEXPOSED CONTROLS

Group A					Group D				
INFECTION PLUS PERLITE					INFECTION WITHOUT DUST				
Infection at Start of Dust Exposure					Controls to Group A				
Animal Number	Duration in Months		Status of Disease		Animal Number	Duration in Months		Status of Disease	
	Perlite Dust	Normal Air				Perlite Dust	Normal Air		
3 K	2	0	S-0	F-0	21 K	0	2	S-0	F-0
4 K	2	0	S-1	F-1	22 K	0	2	S-1	F-1
7 K	4	0	S-1	F-0	23 K	0	4	S-1	F-0
8 K	4	0	S-1	F-1	24 K	0	4	S-1	F-0
9 K	6	0	P-3	F-2	25 K	0	6	S-1	F-1
10 K	6	0	P-2	F-1	26 K	0	6	S-2	F-1
11 K	6	3	P-2	F-1	27 K	0	9	S-0	F-0
12 K	6	3	P-2	F-1	28 K	0	9	S-0	F-1
13 K	6	6	P-4	F-2	29 K	0	12	S-0	F-1
14 K	6	6	S-3	F-3	30 K	0	12	S-0	F-1
15 K	6	9	S-2	F-2	31 K	0	15	S-0	F-0
16 K	6	9	S-3	F-2	32 K	0	15	S-0	F-0
17	6	12	S-1	F-1	34 K	0	18	S-0	F-1
18	6	12	S-2	F-3	35 K	0	18	S-0	F-1

Key: K = Killed
D = Died
S = Stabilizing
P = Progressing
F = Fibrosis (Collagen deposition)
Numbers indicate relative extent of involvement.

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Table 2

COURSE OF TUBERCULOSIS IN ANIMALS
EXPOSED TO PERLITE DUST AND IN INFECTED CONTROLS

Group B					Group E				
INFECTION PLUS PERLITE					INFECTION WITHOUT DUST				
Infection at End of dust exposure					Controls to Group B				
Animal Number	Duration of Months		Status of Disease		Animal Number	Duration in Months		Status of Disease	
	Perlite Dust	Normal Air				Perlite Dust	Normal Air		
57 K	6	2	P-2	F-1	76	0	2	S-1	F-1
58 K	6	2	P-2	F-1	77	0	2	S-1	F-0
60 K	6	4	S-2	F-2	78	0	4	S-0	F-1
61 K	6	4	S-2	F-2	79	0	4	S-1	F-1
(62)			S-3	F-3					
63 K	6	6	S-2	F-2	80	0	6	S-0	F-0
64 K	6	6	S-2	F-2	81	0	6	S-0	F-0
(65)			S-2	F-3					
67 D	6	6	S-3	F-4					
68 K	6	8	S-3	F-4	82	0	8	S-1	F-1
69 K	6	8	S-3	F-3	83	0	8	S-0	F-0
74 D	6	11	S-1	F-3					
72 K	6	12	S-1	F-2	85	0	12	S-0	F-0
73 K	6	12	S-1	F-2	86	0	12	S-1	F-1
75 K	6	12	S-1	F-2	88	0	12	S-0	F-1
					89	0	12	S-0	F-0
					90	0	12	S-0	F-0

Key: K = Killed
D = Died
S = Stabilizing
P = Progressing
F = Fibrosis (Collagen deposition)
Numbers indicate relative extent of involvement.

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