

IN THE COURT OF COMMON PLEAS
CUYAHOGA COUNTY, OHIO

ASBESTOS LITIGATION

IN RE: ALL BARON & BUDD CASES
IN WHICH THE CP HALL COMPANY
IS NAMED AS DEFENDANT

: CASE NO. 073958, et. al.

Plaintiffs,

: (JUDGE HARRY A. HANNA)

-vs-

A-BEST PRODUCTS COMPANY, ET AL.,

Defendants.

PLAINTIFF'S EXHIBIT

CPH-2

**DEFENDANT C. P. HALL COMPANY'S OBJECTIONS AND RESPONSES TO PLAINTIFFS'
MASTER REQUESTS FOR PRODUCTION OF DOCUMENTS**

Now comes Defendant The C.P. Hall Company (*herein* "C.P. Hall"), by and through its counsel, Roetzel & Andress, and for its Responses to Plaintiffs' Request for Production of Documents, herein sets forth as follows:

Defendant CP Hall objects to the entirety of the Instructions and Definitions included in the Plaintiffs' Requests, and agrees only to respond to those Requests in accordance with the Rules of Civil Procedure.

I. INTRODUCTION

The information provided in the Responses to the Requests for Production was assembled by authorized employees and counsel for Defendant C. P. Hall and was obtained primarily from a review of C. P. Hall's records. The information sought by Plaintiffs concerns events that occurred many years ago. Thus, it is difficult, if not impossible, to retrieve or reconstruct some of the information requested by Plaintiffs. Accordingly, C. P. Hall reserves the right to amend these responses if new or more accurate information becomes available or if errors are discovered. Furthermore, C. P. Hall responds to the Requests without prejudice to Defendant's right to rely at trial on subsequently discovered information or on information omitted inadvertently as a result of mistake, error or oversight. It is also noted that persons who are not now employees, officers,

directors or managing agents of C.P. Hall may have information relevant to the subject matter of these requests, and C.P. Hall does not purport, in the following responses, to give the response of any such person.

II. GENERAL OBJECTIONS

Because of the voluminous and broad nature of the discovery served by Plaintiffs upon C.P. Hall, a number of objections which apply and are appropriate in response to many of Plaintiffs' Requests are set out below. To the extent there are additional specific objections not included in the list below which are appropriate for an individual Request, such additional objection will be set out in full in response to the Request.

1. C.P. Hall objects to Plaintiffs' Requests to the extent that they are overly broad, unduly burdensome, repetitive or misleading and to the extent that they seek discovery in violation of the work-product and attorney-client privileges and to the extent that they require responses on behalf of other defendants, persons or entities.

2. C. P. Hall objects to Plaintiffs' Requests to the extent that they fail to relate to the relevant time periods, job sites, working conditions, alleged injuries or products at issue, and are, therefore, irrelevant and not reasonably calculated to lead to discovery of admissible evidence.

3. C.P. Hall objects to Plaintiffs' Requests to the extent that they would require C.P. Hall to provide information that is equally available to Plaintiffs as to C.P. Hall, or seeks information in the public domain or in published medical and scientific literature.

4. Many of these discovery requests call for C.P. Hall to characterize state of knowledge or awareness of a corporation at any given time with regard to a particular fact, event or subject. C.P. Hall can respond to such discovery requests, if at all, only by stating on information and belief the degree of knowledge of a particular fact, event or subject as held by a person at a particular time and such response is in no way intended nor should it be deemed to constitute an acknowledgment by C.P. Hall that such knowledge is attributable to it.

5. C. P. Hall objects to Plaintiffs' Requests to the extent that they are vague and non-specific, and they do not understandably request specific information relevant to the causes of action pleaded by the Plaintiff and do not request an identifiable item or identifiable category of documents.

6. C. P. Hall objects to Plaintiffs' Requests to the extent that they purport to request information concerning mining, manufacturing, installation, removal, or "tear-out" of asbestos-containing products. C.P. Hall never mined, manufactured, installed or removed (tore out) asbestos-containing products, and C.P. Hall does not in any way, acknowledge that it engaged in such activity simply by virtue of responding to this discovery.

C.P. Hall's responses are made without in any way waiving: (1) the right to object, on the grounds of competency, relevancy, materiality, hearsay or any other proper ground, to the use of any such information for any purpose, in whole or in part, in any subsequent stage or proceeding in this action or any other action; or (2) the right to object on any and all grounds, at any time, to any other discovery procedure relating to the subject matter of these requests.

III. REQUESTS FOR PRODUCTION

REQUEST FOR PRODUCTION NO. 1:

Please produce a true and correct copy of each photograph or picture of each asbestos-containing product that Defendant has ever mined, manufactured, sold, marketed, installed, and/or distributed.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant job sites, time period and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C. P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C. P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified, C. P. Hall is unable to respond to this Request. See also, Objections and Answer to Interrogatory No. 5. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 2:

Please produce a true and correct copy of each document which reflects sales of those asbestos-containing products listed in response to Interrogatory No. 5 to any of the job sites listed on Exhibit A, attached hereto.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C. P. Hall Company with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C. P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C. P. Hall is unable to respond to this Request.

REQUEST FOR PRODUCTION NO. 3:

Please produce a true and correct copy of each document which reflects sales of Defendant's asbestos-containing products to companies that may have distributed, packaged, labeled, and/or sold Defendant's asbestos-containing products.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C. P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C. P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified, C. P. Hall is unable to respond to this Request.

REQUEST FOR PRODUCTION NO. 4:

Please produce a true and correct copy of each record and/or contract which reflects the sales of Defendant's asbestos-containing products to any of the job sites listed on Exhibit A, attached hereto.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and

products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request.

REQUEST FOR PRODUCTION NO. 5:

Please produce a true and correct copy of each record and/or contract which reflects the sales of Defendant's asbestos-containing products to distributors and marketers who may have called on any of the job sites listed on Exhibit A, attached hereto.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Without waiving any objections, Defendant C. P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 6:

Please produce a true and correct copy of each contract and/or work order that reflects contracts for Defendant to have asbestos-containing products installed or removed at any of the job sites listed on Exhibit A, attached hereto.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 7:

Please produce a true and correct copy of each work order and contract that reflects contract business between Defendant and any of the job sites listed on Exhibit A, attached hereto, for the application of asbestos-containing products.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 8:

Please produce a true and correct copy of each document relating to the design and preparation of the asbestos-containing products listed in Defendant's answer to Interrogatory No. 5.

RESPONSE:

See Objections and Answer to Interrogatory No. 5. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 9:

For each product listed in response to Interrogatory No. 5, please produce a copy of all tests that were conducted to determine any potential health hazards involved in its use or exposure (this Request for Production relates to Plaintiffs' Interrogatory No. 18 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 18. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 10:

Please produce a true and correct copy of all documents relating to the testing of any product which Defendant listed in response to Interrogatory No. 5 (this Request for Production relates to Plaintiffs' Interrogatory No. 19 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 19. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 11:

Please produce a true and correct copy of all tests which Defendant conducted and/or has in its possession to determine potential health hazards involved in the use of or exposure to asbestos products listed in response to Interrogatory No. 5 (this Request for Production relates to Plaintiffs' Interrogatory No. 21 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 21. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 12:

Please produce a true and correct copy of all studies which Defendant conducted or caused to be conducted concerning the effects of the inhalation of asbestos dust and/or fibers in workers or other persons using, working with and/or around, installing and/or applying any of the asbestos products mined, manufactured, sold, distributed, marketed, installed and/or relabelled for distribution by Defendant or Defendant's predecessor (this Request for Production relates to Plaintiffs' Interrogatory No. 22 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 22. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 13:

Please produce a true and correct copy of all documents relating to any studies made or caused to be made by Defendant, to determine whether the asbestos-containing products mined, manufactured, sold, marketed, installed or distributed by Defendant or Defendant's predecessor would be hazardous to people (this Request for Production relates to Plaintiffs' Interrogatory No. 23 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 23. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 14:

Please produce a true and correct copy of all tests in the field which Defendant conducted or caused to be conducted to determine the nature and extent of asbestos dust and/or fiber exposure to insulators, applicators, fellow employees or other workers removing and/or tearing out asbestos-containing products (this Request for Production relates to Plaintiffs' Interrogatory No. 24 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 24. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 15:

Please produce a true and correct copy of each test which Defendant conducted or caused to be conducted regarding the quantity, quality, or threshold limit value of asbestos dust, fibers, and/or particles to which workers were exposed while using, working with and/or around, installing and/or applying Defendant's asbestos-containing products (this Request for Production relates to Plaintiffs' Interrogatory No. 31 previously propounded to Defendant in this litigation).

RESPONSE:

See Objections and Answer to Interrogatory No. 31.

REQUEST FOR PRODUCTION NO. 16:

For each product listed in response to Interrogatory No. 5, please produce a true and correct copy of all promotional or sales material including, but not limited to, brochures, pamphlets, catalogs, packaging, or other written materials of any kind or character.

RESPONSE:

See general Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, locations and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. See also, Objections and Answer to Interrogatory No. 5. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 17:

Please produce a true and correct copy of all warnings, cautions, caveats or directions concerning the possible health effects of the products listed in response to Interrogatory No. 5 (this Request for Production relates to Plaintiffs' Interrogatory No. 41 previously propounded to Defendant).

RESPONSE:

See Objections and Answers to Interrogatory Nos. 5 and 41. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 18:

Please produce a true and correct copy of all written materials prepared by Defendant or Defendant's predecessors or any of Defendant's subsidiaries indicating how the products listed in response to Interrogatory No. 5 should be used or maintained by the ultimate user (this Request for Production relates to Plaintiffs' Interrogatory No. 43 previously propounded to Defendant).

RESPONSE:

See Objections and Answer to Interrogatory No. 43. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 19:

Please produce a true and correct copy of all notices received by Defendant prior to 1968 that any person was claiming injury or had sustained an abnormal x-ray reading as a result of using asbestos-containing products mined, manufactured, sold, marketed, installed, or distributed by Defendant (this Request for Production relates to Plaintiffs' Interrogatory No. 48 previously propounded to Defendant).

RESPONSE:

See Objections and Answer to Interrogatory No. 48. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 20:

Please produce a true and correct copy of statements from all people with knowledge of relevant facts to this lawsuit.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant C.P. Hall furthermore objects to the extent that this Request seeks confidential information protected by the attorney client privilege and/or work product doctrine. Without waiving objections, Defendant C.P. Hall states that it will identify its fact witnesses in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 21:

Please produce a true and correct copy of all documents which mention, allude or refer to tests performed on breathing devices to prevent the inhalation of asbestos dust and/or fibers (this Request for Production relates to Plaintiffs' Interrogatory No. 52 previously propounded to Defendant).

RESPONSE:

See Objections and Answer to Interrogatory No. 52.

REQUEST FOR PRODUCTION NO. 22:

Please produce a true and correct copy of all reports by experts that Defendant may call upon at the trial of this case (this Request for Production relates to Plaintiffs' Interrogatory No. 53 previously propounded to Defendant).

RESPONSE:

See Objections and Answer to Interrogatory No. 53. Without waiving any objections, Defendant C.P. Hall will identify its expert witnesses and will provide any written materials related thereto in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 23:

Please produce a true and correct copy of all policies of insurance under which any person carrying on an insurance business may be liable to satisfy part or all of a judgment which may be entered in the action or to indemnify or reimburse for payments made to satisfy the judgment.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is premature, vague, overly broad and unduly burdensome. C.P. Hall further objects to this Request because it seeks information, which is neither relevant to the subject matter of the case nor reasonably calculated to lead to the discovery of admissible evidence. It is, therefore, outside the scope of permissible discovery. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 24:

Please produce a true and correct copy of all notices received by Defendant prior to 1968 that any person was claiming an injury or had sustained an abnormal x-ray reading as a result of using asbestos-containing products, regardless of the manufacturer or seller of the products.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since, among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 25:

Please produce a true and correct copy of all documents, correspondence or communications pertaining to all marketing, sales, negotiations, delivery or distribution of all of your asbestos-containing or industrial insulation products to all Defendants to this lawsuit other than the answering Defendant.

RESPONSE:

See General Objections. Defendant objects to this Interrogatory insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and their periods involved in this litigation are identified, C.P. Hall is unable to respond to this Request. Defendant also objects to this Request to the extent that it seeks documents that are confidential and protected by the attorney-client and work product privileges; and to the use of the term "your asbestos-containing products."

REQUEST FOR PRODUCTION NO. 26:

Please produce a true and correct copy of all documents memorializing or referring, relating or pertaining to communications or correspondence among and/or between your officers, director, agents, representatives, employees or consultants and any employer, purchaser or user of your asbestos-containing products, its officers, directors, agents, representatives, employees or consultants which in any way relates, refers or pertains to asbestos, asbestos-containing products, pneumoconiosis, asbestos-related illness, injury or disease, dust or workplace health or safety.

RESPONSE:

See general Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant further objects to the

extent that this Request seeks confidential information protected by the attorney-client and/or work product privileges.

REQUEST FOR PRODUCTION NO. 27:

Please produce a true and correct copy of all annual reports of Defendant to employees or stock holders for the years 1960 through 1969 and for the past five years.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad and unduly burdensome. Defendant C.P. Hall further objects to this Request insofar as it seeks information that is neither relevant to the subject matter of the case nor reasonably calculated to lead to the discovery of admissible evidence. It is, therefore, outside the scope of permissible discovery.

REQUEST FOR PRODUCTION NO. 28:

Please produce the originals or true and correct copies of all safety or health manuals, pamphlets or brochures issued by Defendant between 1930 and the present and any documents relating to whom said manuals were issued.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is vague, non-specific, overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation.

REQUEST FOR PRODUCTION NO. 29:

Please produce a true and correct copy of all safe workplace practices manuals, pamphlets or brochures issued by Defendant from 1900 through the present.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, there is no allegation that Plaintiffs were employed by C.P. Hall or worked at any C.P. Hall job sites.

REQUEST FOR PRODUCTION NO. 30:

Please produce a true and correct copy of all documents referring, relating or pertaining to the Industrial Health Foundation or the Industrial Hygiene Foundation in the custody, possession or control of Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 31:

Please produce a true and correct copy of all documents referring, relating or pertaining to the Trudeau Institute and Saranac Lake Laboratory in the custody, possession or control of Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 32:

Please produce a true and correct copy of all documents referring, relating or pertaining to the Quebec Asbestos Mining Association (QAMA) in the custody, possession or control of Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 33:

Please produce a true and correct copy of all documents referring, relating or pertaining to the National Insulation Manufacturers Association (NIMA) in the custody, possession or control of Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time period, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no

documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 34:

Please produce a true and correct copy of all documents referring, relating or pertaining to the Thermal Insulation Manufacturers Association (TIMA) in the custody, possession or control of Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time period, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 35:

Please produce a true and correct copy of all documents relating to any conferences, symposia, or meetings attended by any of your officers, physicians, agents, servants, employees or consultants which in any way considered, discussed, reviewed or made recommendations concerning asbestos-related illness, injury or disease; pneumoconiosis; occupational lung disease; dust; industrial hygiene; and/or worker or workplace health or safety.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is vague, overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods. Defendant further objects to this Request to the extent that it seeks information protected by the attorney-client and work product privileges. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 36:

Please produce a true and correct copy of all documents to and/or from Defendant and any person, organization, institution, laboratory, foundation, corporation, entity, board or consultants which refer, relate or pertain to air quality studies, dust counts or dust studies, alleged maximum allowable concentrations (MAC), alleged threshold limit values (TLV) or protection of your employees or any other employees or persons from actual or alleged hazards associated with asbestos exposure.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods. Defendant further objects to this Request to the extent that it seeks information protected by the attorney-client and work product privileges. Without waiving any objections, see attached.

REQUEST FOR PRODUCTION NO. 37:

Please produce a true and correct copy of all documents to and/or from Defendant and any person, organization, institution, laboratory, foundation, corporation, entity, board or consultants which refer, relate or pertain to air quality studies, dust counts or dust studies, alleged maximum allowable concentrations (MAC), alleged threshold limit values (TLV) or protection of your employees or any other employees or persons.

RESPONSE:

See Objections and Response to Request No. 36.

REQUEST FOR PRODUCTION NO. 38:

Please produce a true and correct copy of all documents to and/or from Defendant involving any physician, industrial hygienist or public health specialist which in any way relates, refers or pertains to asbestos-related injury, illness or disease, pneumoconiosis, occupational lung disease, dust, industrial hygiene or worker or workplace health or safety.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant diseases, time periods, job sites and products at issue in this litigation. Defendant further objects to the extent that this Request seeks confidential information protected by the attorney client privilege and/or work product privileges.

REQUEST FOR PRODUCTION NO. 39:

Please produce a true and correct copy of all photographs, pictures, prints or any visual depiction at any time generated showing workers or any person or persons installing, applying, removing or in any manner handling or utilizing an asbestos-containing product at any time manufactured, sold or distributed by Defendant.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 40:

Please produce a true and correct copy of all documents pertaining to the acquisition, purchase or sale by Defendant of any asbestos-containing product manufacturing facility or asbestos-containing product or product line.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Defendant further objects to this Request insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine. Without waiving any objections, Defendant C.P. Hall has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 41:

Please produce a true and correct copy of all documents pertaining to the acquisition, purchase or sale by Defendant of any asbestos-containing product from any other Defendant in this case or to any other Defendant in this case.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant further objects to this Request insofar as it seeks confidential information protected by the attorney client and/or work product privileges.

REQUEST FOR PRODUCTION NO. 42:

For each and every affirmative defense asserted in Defendant's Answer to Plaintiffs' Complaint, the cross-claims or counter-claims of any party against Defendant, produce each and every document which will be offered to prove each and every affirmative defense. For each and every allegation of Defendant in cross-claim(s) asserted by Defendant in this litigation, produce each and every document which will be offered to prove each and every allegation in Defendant's cross-claim(s).

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify its exhibits in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 43:

Please produce a true and correct copy of every transcript of testimony of each witness Defendant intends to call at trial.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify its witnesses in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 44:

Please produce a true and correct copy of each and every medical record in the custody, possession or control of Defendant relating to Plaintiffs in this case other than those medical records produced by Plaintiffs and provided to Defendants in this case.

RESPONSE:

To the best of Defendant's current knowledge, information and belief, Defendant has no documents responsive to this Request.

REQUEST FOR PRODUCTION NO. 45:

Please produce a true and correct copy of each and every document or other tangible item upon which Defendant will rely for impeachment or rebuttal purposes in the trial of this matter.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify any documents responsive to this Request in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 46:

Please produce a true and correct copy of each and every document, recording or other tangible item that constitutes in whole or in part a statement by Plaintiffs or a statement by any of Plaintiffs' witnesses in this matter.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant further objects to the extent that this Request seeks confidential information protected by the attorney-client and/or work product privileges. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify any discoverable documents responsive to this Request in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 47:

Please produce a true and correct copy of each and every photograph, videotape recording or other tangible item that is a photographic representation of Plaintiffs in this matter.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P.

Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant further objects to the extent that this Request seeks confidential information protected by the attorney-client and/or work product privileges. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify any discoverable documents responsive to this Request in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 48:

Please produce a true and correct copy of all work records or other tangible items relating to Plaintiffs or their employers.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant and not reasonably calculated to lead to the discovery of admissible evidence, since among other things, it is not limited to the relevant time periods, job sites and products at issue in this litigation. Furthermore, Plaintiffs have failed to provide Defendant C.P. Hall with sufficient information to enable it to respond to this Request. To date, Defendant has only received general information, which lacks specificity, and for that matter, any allegations regarding the identification of an asbestos-containing product for which C.P. Hall could be responsible in this litigation. Until the products, job sites and time periods involved in this litigation are identified C.P. Hall is unable to respond to this Request. Defendant further objects to the extent that this Request seeks confidential information protected by the attorney-client and/or work product privileges. Without waiving any objections, discovery is ongoing. Defendant C.P. Hall will identify any discoverable documents responsive to this Request in accordance with the Court's Case Management Order.

REQUEST FOR PRODUCTION NO. 49:

Please produce a true and correct copy of every transcript, affidavit or sworn statement by each and every witness called by Defendant in any litigation related to insurance that may cover the claims in this case.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine.

REQUEST FOR PRODUCTION NO. 50:

For each document for which any privilege is asserted, produce an index containing the following information:

- (a) Author of document;
- (b) Position, title or affiliation of author;
- (c) Date of document;
- (d) Each recipient of the document
- (e) The position, title or affiliation of each recipient of the document;
- (f) The subject matter of the document with sufficient specificity to determine the matters discussed therein; and
- (g) The privilege(s) asserted.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine.

REQUEST FOR PRODUCTION NO. 51:

If Defendant claims that the documents are too voluminous to produce as requested, provide the following:

- (a) The numerical amount of documents responsive to requests herein;
- (b) The method of storage of documents responsive to requests herein;
- (c) The method of organization of documents responsive to requests herein;
- (d) The location of documents responsive to requests herein;
- (e) Whether there is an index or indices, lists, inventories, or other such information for records responsive to requests herein;
- (f) If there is an index, indices, lists, inventories or other such information for records responsive to requests herein, whether such index, indices, lists, inventories or other such information for records responsive herein is printed, or electronically stored, (i.e. listed in a computer, imaged, part of a database, etc.).
- (g) If the index, indices, lists, inventories or other such information for records responsive to requests herein, whether such index, indices, lists, inventories or other such information for records responsive herein is electronically stored, (i.e. listed in a computer, imaged, part of a database, etc.), the method of such storage and software used to create and/or maintain said an index, indices, lists, inventories or other such information for records responsive to requests herein, whether such index, indices, lists, inventories or other such information for

records responsive herein.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine.

REQUEST FOR PRODUCTION NO. 52

If any answer to requests herein is subject to an ongoing investigation or continuing discovery, provide the following information:

- (a) The person or persons responsible for the ongoing investigation or continuing discovery;
- (b) The means or methods used or being used for the ongoing investigation or continuing discovery;

The beginning date of such ongoing investigation or continuing discovery.

RESPONSE:

See General Objections. Defendant objects to this Request insofar as it is overly broad, unduly burdensome, irrelevant, not reasonably calculated to lead to the discovery of admissible evidence, beyond the scope of permissible discovery, and insofar as it seeks confidential information protected by the attorney client privilege and/or work product doctrine.

Respectfully submitted,

Susan Squire Box - 0029988
ROETZEL & ANDRESS
222 South Main Street
Suite 400
Akron, OH 44308
(330) 376-2700

**ATTORNEY FOR DEFENDANT
C.P. HALL CORPORATION**



R.T. Vanderbilt Company, Inc.

30 Winfield Street, Norwalk, CT 06855 (203) 853-1100
West Coast: 6279 E. 1st Salmon Avenue, Los Angeles, CA 90040 (213) 723-5200

MINERAL PRODUCT SAFETY DATA SHEET

NOTE: Exposure to all airborne mineral dusts is subject to OSHA regulations in accordance with Section 1910.93 of the Occupational Health and Safety Administration Standard as published in the Federal Register of October 18, 1972, starting on page 22139.

DATE: May 1, 1975

SECTION I	
TRADE NAME AND SYNONYMS	IT X, IT 3X, IT 5X, IT FT, IT 325, IT 625 Industrial Talc
MINERAL FAMILY	Hydrous silicates
CHEMICAL COMPOSITION	Complex hydrous calcium magnesium silicates

MATERIAL	SECTION II INGREDIENTS	% RANGE
Talc		20 - 40
Non-asbestiform tremolite and/or anthophyllite		40 - 60
Serpentine		20 ⁺ - 30
Quartz		1 - 5

SECTION III PHYSICAL DATA			
COLOR	White	SPECIFIC GRAVITY (H ₂ O=1)	±2.8
APPEARANCE	Powder		
OTHER PROPERTIES			

MATERIAL	SECTION IV HEALTH HAZARD DATA	TLV*
Talc		20 Mppcf
Non-asbestiform tremolite and anthophyllite		20 Mppcf
Serpentine		50 Mppcf
Quartz	30 mg./cu.m. ± & Quartz +2	

* TLV's must be determined by the individual user based on the mineral composition of the airborne dust at any particular location in the plant. The composition of the airborne dust may bear no relation to the actual percentage composition of the product in question.

SECTION V SPECIAL PRECAUTIONS
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid breathing dust. Use respirator if TLV's exceeded.

This information is furnished solely for the purpose of disclosure regarding health hazard and shall not be used or relied upon by any person for any other purpose.

*TLV's must be determined by the individual user based on the mineral composition of the airborne dust at any particular location in the plant. The composition of the airborne dust may bear no relation to the actual percentage composition of the product in question.

RECEIVED JAN 16 1992

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

Form Approved
OMB No. 44-R1387

MATERIAL SAFETY DATA SHEET

Required under USDL Safety and Health Regulations for Ship Repairing,
Shipbuilding, and Shipbreaking (29 CFR 1915, 1916, 1917)

SECTION I

MANUFACTURER'S NAME Canadian Johns-Manville Co. Ltd.		EMERGENCY TELEPHONE NO. 819-879-5431
ADDRESS (Number, Street, City, State, and ZIP Code) P. O. Box 1500, Asbestos, P. O. Canada		
CHEMICAL NAME AND SYNONYMS Hydrous Magnesium Silicate	TRADE NAME AND SYNONYMS All J-M Asbestos Products Plastibest, Paperbestos Utrabestos	
CHEMICAL FAMILY	FORMULA Mg₆((OH)₄Si₂O₅)₂	

SECTION II - HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Units)
PIGMENTS None			BASE METAL		
CATALYST "			ALLOYS		
VEHICLE "			METALLIC COATINGS		
SOLVENTS "			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES "			OTHERS		
OTHERS "					
HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES				%	TLV (Units)
None					

SECTION III - PHYSICAL DATA

BOILING POINT (°F.) (Asbestos is a solid mineral)	SPECIFIC GRAVITY (H ₂ O=1) 2.4-2.6
VAPOR PRESSURE (mm Hg.) Negligible	PERCENT VOLATILE BY VOLUME (%)
VAPOR DENSITY (AIR=1)	EVAPORATION RATE Does not evaporate
SOLUBILITY IN WATER Negligible	
APPEARANCE AND ODOR Grey, fibrous, odorless	

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) Non Inflammable	FLAMMABLE LIMITS	Lel	Uel
EXTINGUISHING MEDIA			
SPECIAL FIRE FIGHTING PROCEDURES None			
UNUSUAL FIRE AND EXPLOSION HAZARDS None			

SECTION V - HEALTH HAZARD DATA	
THRESHOLD LIMIT VALUE	12 Fibres/cc over 5 microns long.
EFFECTS OF OVEREXPOSURE	Prolonged continuous exposure to asbestos dust may cause impairment to the respiratory system.
EMERGENCY AND FIRST AID PROCEDURES	NA

SECTION VI - REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATABILITY (Materials to avoid) None			
HAZARDOUS DECOMPOSITION PRODUCTS None			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Spillage should be cleaned up by aspiration. Avoid sweeping or other methods causing asbestos to become airborne.	
WASTE DISPOSAL METHOD Use plastic bags for transportation dispose of waste in earth filled dump.	

SECTION VIII - SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type) Dustfoe No. 77 U. S. Bureau of Mines Approval #21B-97.			
VENTILATION	LOCAL EXHAUST Sufficient to keep dust count below TLV shown in Section V.		SPECIAL
	MECHANICAL (General)		OTHER
PROTECTIVE GLOVES Not required		EYE PROTECTION Not required	
OTHER PROTECTIVE EQUIPMENT			

SECTION IX - SPECIAL PRECAUTIONS	
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Care should be taken to avoid asbestos dust becoming airborne.	
Repair broken bags, remove spillage, clean storage area by aspiration.	
OTHER PRECAUTIONS	

INSURANCE COVERAGE FOR THE C. P. HALL COMPANY (INCLUDING PRODUCTS)

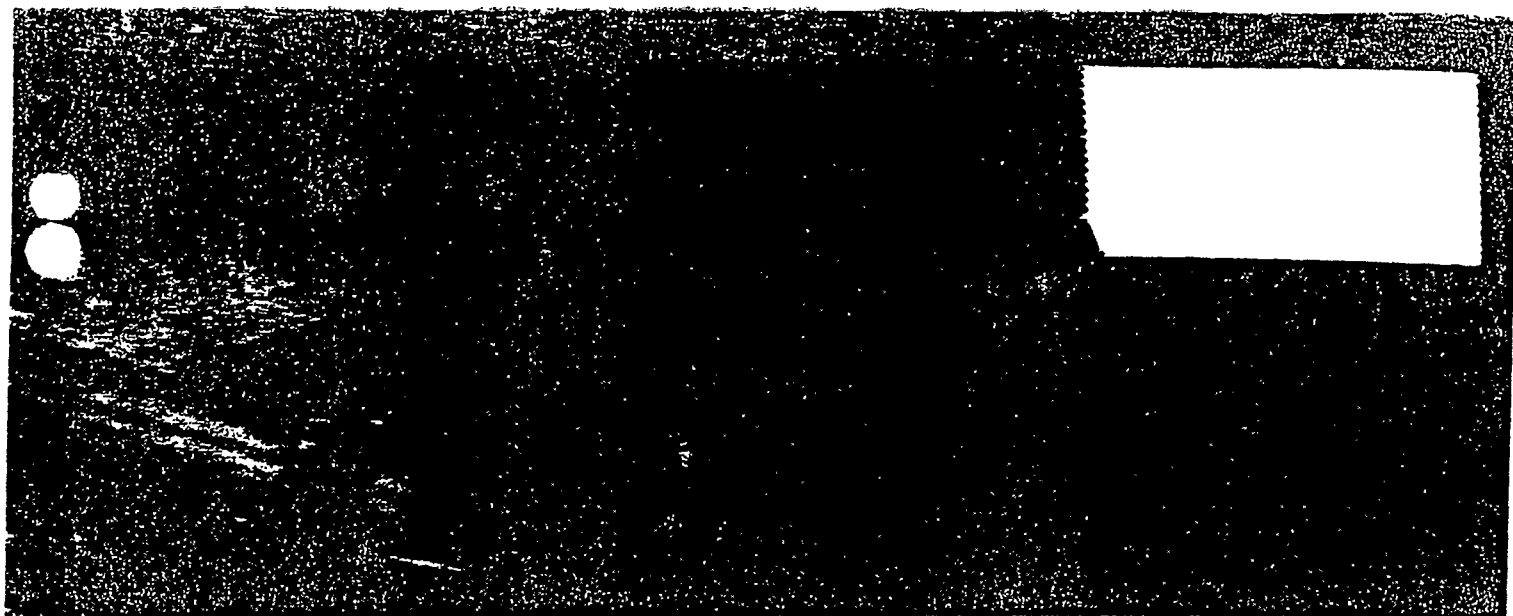
<u>Insurer</u>	<u>Policy #</u>	<u>Period</u>	<u>Limits of Liability</u>	<u>Primary Coverage</u>	<u>Deductible</u>
New Amsterdam Casualty Agent E. L. Garrigan	LGC-313695	6/1/61-10/1/61	150/300/150M	Yes	None
	LGC-318955	10/1/61-10/1/62	150/300/150M	Yes	None
	LGC-318903	10/1/62-10/1/63	150/300/150M	Yes	None
	LGC-319039	10/1/63-10/1/64	150/300/150M	Yes	None
	LGC-350567	10/1/64-10/1/65	150/300/150M	Yes	None
	LGC-319039	10/1/65-10/1/66	150/300/150M	Yes	None
The Travelers Agt. John M. Timmons Producer: Starkweather & Shepley	KSLG 510631	9/30/62-9/30/63	\$300/500M BI \$500,000 Aggregate Products	Yes	None
	KSLG 1398236	9/30/63-9/30/64	\$300/500M BI \$500,000 Aggregate Products	Yes	None
	KSLG 2193434	9/30/64-9/30/65	\$300/500M BI \$500,000 Aggregate Products	Yes	None
	KSLG 2617729	9/30/65-9/30/66	\$300/500M BI \$500,000 Aggregate Products	Yes	None

<u>Insurer</u>	<u>Policy #</u>	<u>Period</u>	<u>Limits of Liability</u>	<u>Coverage</u>	<u>Deductible</u>
The Travelers Agt. John M. Timmons	KSLG 3465745	9/30/66-9/30/67	\$300/500M BI \$500,000 Aggregate products	Yes	None
	KSLG 2255544	9/30/67-9/30/68	\$300/500M BI \$500,000 Aggregate products	Yes	None
Great American	1198142	10/1/66-11/29/66			
Security Insurance Co. Agent E. L. Garrigan	GLA 462252	11/29/66-11/29/67	150/300/150M	Yes	None
	GLA 499486	11/29/67-11/29/68	150/300/150M	Yes	None
	GLA-530985	11/29/68-11/29/69	150/300/150M	Yes	None
American Mutual Insurance Co.	BLBP 768188-02-8D	9/30/68-9/30/69	\$300/500M BI \$500,000 Aggregate products	Yes	None
American Mutual Insurance Co.	MOP-768188-04-9-D	9/30/69-9/30/70	\$300/500M BI	Yes	None
	MLP-768188-04-9-D	9/30/69-9-30/70	\$500,000 Aggregate products		
Employee Commercial Union Agt. Rockwood Co.	SMP EM 40086-53	9/30/70-6/30/72	\$300/500M BI \$500,000 Aggregate	Yes	None

The Hartford
Agt. E. L.
Garrigan

45-C-679131	11/29/69-11/29/70	\$300/500M BI	Yes	None
		\$500,000 Aggregate		
45-C-680562	11/29/70-11/29/71	\$300/500M BI	Yes	None
		\$500,000 Aggregate		
45-C-681787	11/29/71-6/30/72	\$300/500M BI	Yes	None
		\$500,000 Aggregate		
45-CBP-130536	**6/30/72-6/30/75	\$300/500M BI	Yes	None
		\$500,000 Aggregate		
45-CBP-130781	6/30/75-6/30/78	\$1,000,000 E/O	Yes	None
		\$1,000,000 Aggregate		
45-CBP-131113	7/01/78-7/01/81	\$1,000,000 E/O	Yes	None
		\$1,000,000 Aggregate		
45-UC-200167	7/01/81-10/01/84	\$1,000,000 E/O	Yes	\$1,000
		\$1,000,000 Aggregate		

** The C. P. Hall Company of Illinois and The C. P. Hall Company merged on 10/01/71. Insurance policies combined as of 6/30/72.



JOHNS-MANVILLE ASBESTOS FIBER



INDESTRUCTIBLE BY NATURE • INVULNERABLE TO

ASBESTOS

the
magic
mineral

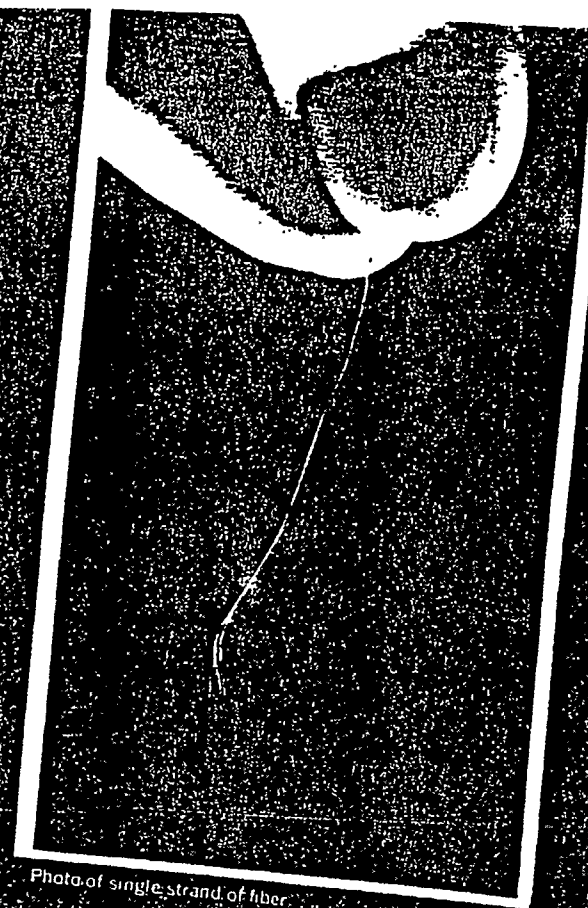


Photo of single strand of fiber



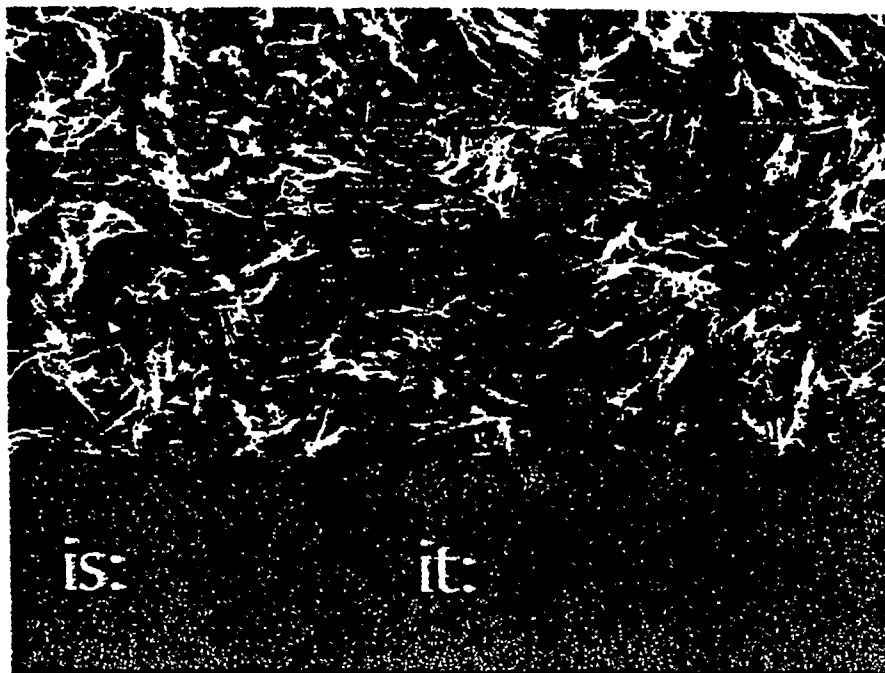
Versatile, fire-resistant ASBESTOS FIBER...

...strong as steel wire, durable as stone, and pliable as cloth

To the scientist, chrysotile asbestos is a hydrous magnesium silicate. What this means in terms of product quality can be said, simply, in one word: strength. While this is an over-simplification, it illustrates the key characteristic of Johns-Manville Asbestos Fiber.

THE MAGIC MINERAL

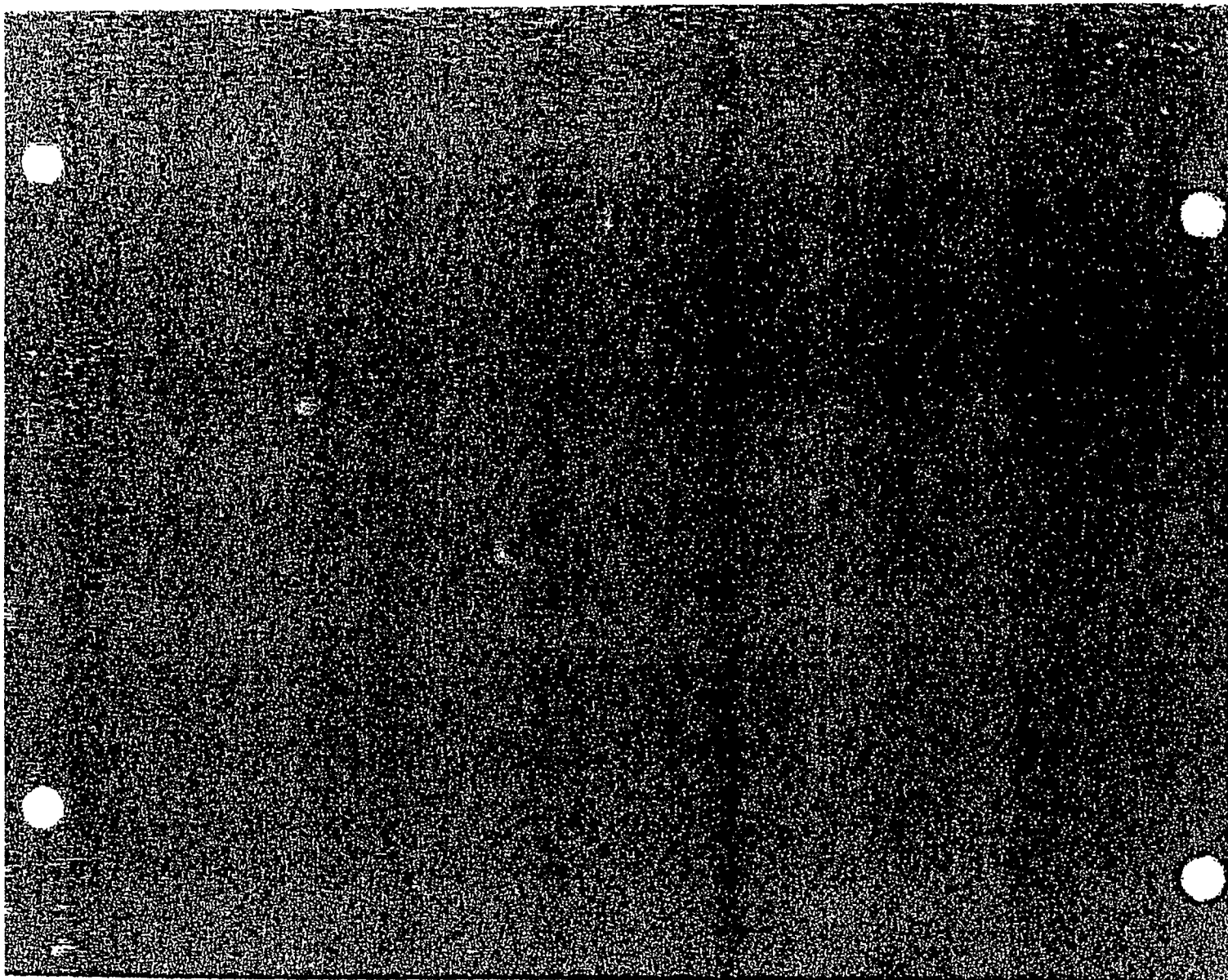
endowed by nature—
refined by science



Because of its versatility, asbestos is applied to an amazing variety of products such as textiles, paper, plastics, cement products, friction materials, and floor tile, to mention a few. With the advent of new uses each year, the list is continually growing. This amazing mineral, capable of solving so many product formulation problems, is the heart of the Johns-Manville Corporation.

For over a century, Johns-Manville has been perfecting the techniques of mining and milling chrysotile asbestos fiber in an effort to keep modern industry supplied in ever-increasing quantities.

The phenomenal increase in asbestos fiber production, generated by the demands of industry for this unique yet basic mineral, is reflected in the growth of the Johns-Manville Asbestos Fibre Division.



Jeffrey Mine skipway at Asbestos, Quebec

500,000 tons
shipped
each year

In a little more than 25 years, the number of grades of fiber produced and processed has increased from six to over sixty and total capacity from 90,000 to 500,000 tons.

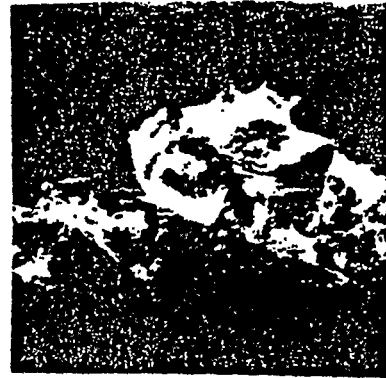
Johns-Manville operates asbestos mines in the Canadian provinces of Quebec, Ontario and Newfoundland, and at Coalinga, California, producing all of the grades of chrysotile asbestos fiber required by industry. Along with Johns-Manville, modern industry depends on these mines, and the processing techniques used there, for the fiber so necessary in the formulation of countless quality products.

As the demand for fiber increased throughout the world so did the need to find gradations in fiber quality and dimension. A constant program of research and development, coupled with expanding scientific and production facilities, enabled Johns-Manville to stimulate and lead this trend.

A HUGE MINE...

a modern mill ...

...a carefully graded, versatile material



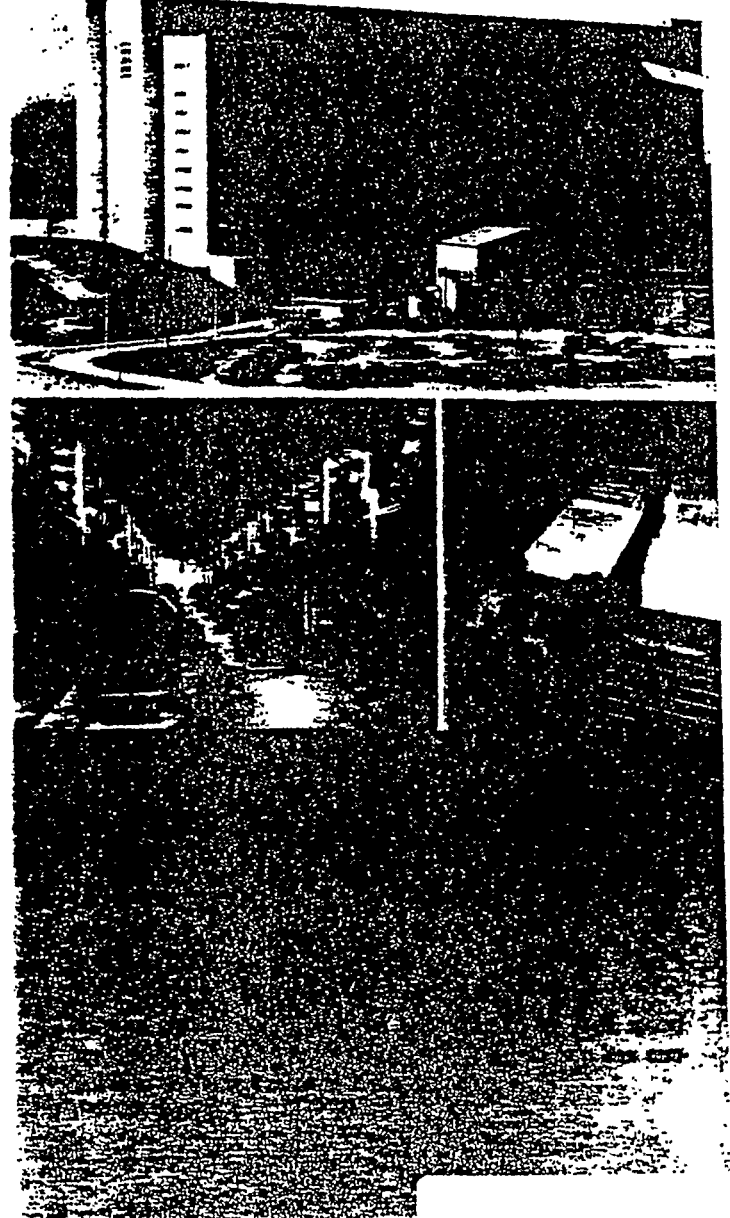
While nature was generous when endowing asbestos, she was also devious. The precious, white silky fibers occur embedded in serpentine rock, having a chemical composition similar to the fiber itself. Tremendous tonnages of rock must be removed to recover relatively small amounts of the "magic mineral". To accomplish this, Johns-Manville operates the free world's largest mine and largest, most modern asbestos mill. It is here that the crude asbestos rock is painstakingly reduced to its useful fiber form.



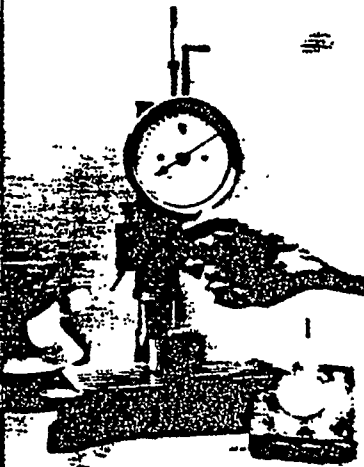
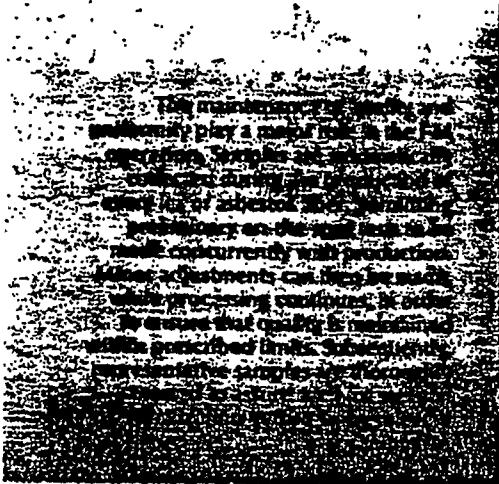
Johns-Manville
Quebec

All the asbestos
obtained here
at a rate of 100,000
tons a year is
J-M's largest source
becoming ever more
diverted and disposed

THE MILL



Asbestos fiber is available in over 60 standard and special grades. Each designation defines a distinct grade that is suitable for certain industrial applications. These grades are further defined as to textural characteristics. Such specialization provides fiber grades which meet the requirements of many existing products. It also gives the Research and Development Engineer the confidence that he can depend on Johns-Manville Asbestos to provide a fiber to meet his requirements for new products. For details on Johns-Manville asbestos fiber classification, see chart on page 10.



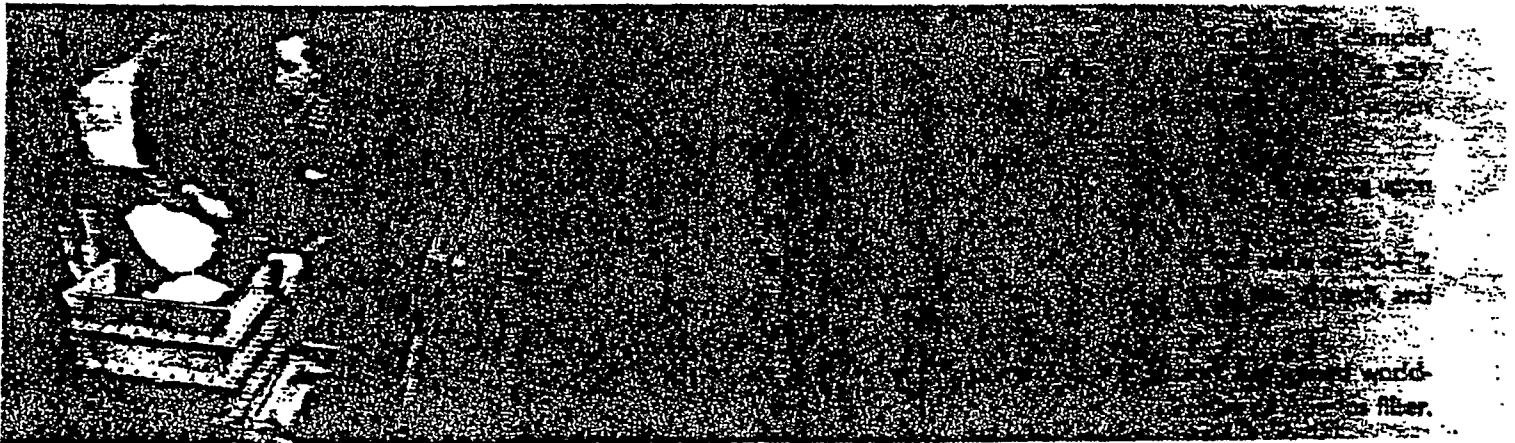
Determining fiber bulking characteristics



Strength Test

THE QUEBEC STANDARD TESTING METHOD

In the Quebec Standard Screen Test used for the classification of Jeffrey Mine products, a measure of the length distribution of the fiber is obtained by subjecting a 16 oz. sample to a dry screening operation. The equipment required for this purpose is the Quebec Standard Asbestos Testing Machine which consists essentially of a nest of 4 screen boxes measuring $24\frac{1}{2}$ " x $14\frac{3}{4}$ " clamped to a motor driven shaker table. The bottoms of the three upper boxes are made from brass screen wire having openings of .500", .187" (4 mesh) and .053" (10 mesh) respectively, while the lowest box is a receptacle for fines which fall through the other three.



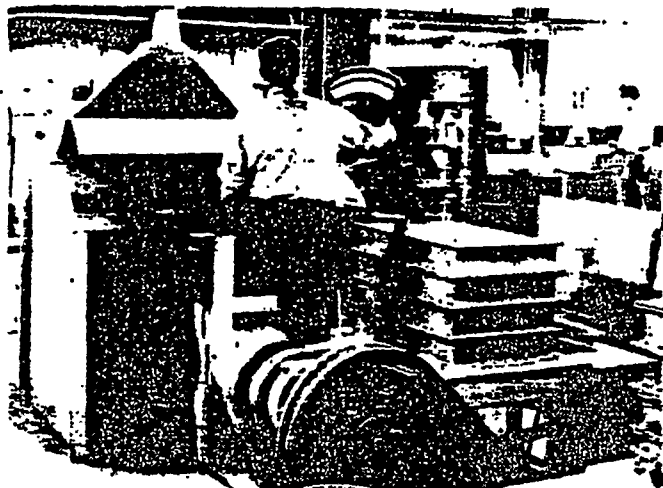
Operator conducting Q.S.

ONE TEST AFTER ANOTHER

Few other minerals in use today are subjected to the amount of testing Johns-Manville demands of its asbestos fibre. In addition to the Quebec test outlined here, crude and milled fiber are continually subjected to tests in order to measure and maintain wet and dry volumes, adsorption characteristics, settling rates, grit content, density and degree of fiberization. It is this attention to control of product quality which gives Johns-Manville fiber the best quality-to-cost ratio in the asbestos fiber industry.

FIBER DEVELOPMENT

The Mill at Asbestos also houses the Fiber Development Department comprising some 25 skilled specialists and technicians who continually test new equipment and evaluate new and improved milling techniques. In accordance with their recommendations new machinery is installed and a continuous program of modernization is maintained. This Department operates a pilot plant within the Mill duplicating the essential items of equipment utilized in the full scale mill thus enabling bulk samples and small orders of special grades to be prepared under close supervision.



Fiber Development control lab, Asbestos, Quebec



J-M Research Center, Manville, N. J.

RESEARCH CENTER

The J-M Research & Engineering Center at Manville, New Jersey houses laboratories and staff devoted to basic research on the properties of asbestos, and applied research into the use of asbestos to meet industrial needs. Many innovations in the field of asbestos application, ranging from routine products for better homes to exotic aerospace discoveries, are a direct result of this extensive research program.

The aid of the Research & Engineering Center is frequently enlisted in the resolution of difficult customer problems and in the development of fiber grades suitable for applications where standard materials are not satisfactory.

SALES SERVICE

Asbestos Fibre Division Special Representatives, experienced in the application of asbestos in industry, are available throughout the United States and Canada. Your representative can assist in the selection of the grade best suited to your product or help resolve problems involving the use or the handling of asbestos.

In addition, J-M engineers and technologists at the Mines and Research Laboratories, trained in every phase of fiber development, production, utilization, and packaging, may be called upon to assist with major problems.

While the classification system provides a quick reference which can be used as a general guide in the selection of fiber grades, many users prefer to make their own evaluations and set standards to suit their particular requirements. Frequently, the choice of a fiber grade is the final outcome of an investigation made in the user's plant during which samples have been evaluated in pilot production or laboratory tests.

J-M engineers are available throughout such experimental periods to give advice and assistance. They are prepared to interpret the results of plant production trials, translate them into terms of fiber characteristics and finally, to set up asbestos fiber manufacturing specifications as may be required.

Flexibility of production facilities, experienced personnel, and continuous research are the essential ingredients of this effective approach to the solution of problems involving the use of asbestos fiber. They ensure that J-M customers get the grade best suited to their needs.

PACKAGING

Because of shipping distances, transportation and handling charges may account for a significant portion of the delivered cost of asbestos fiber. Correct selection of package type plus careful planning of car loading systems for maximum utilization of mechanical handling equipment, however, do much to minimize these costs.

VARIOUS J-M PACKAGES

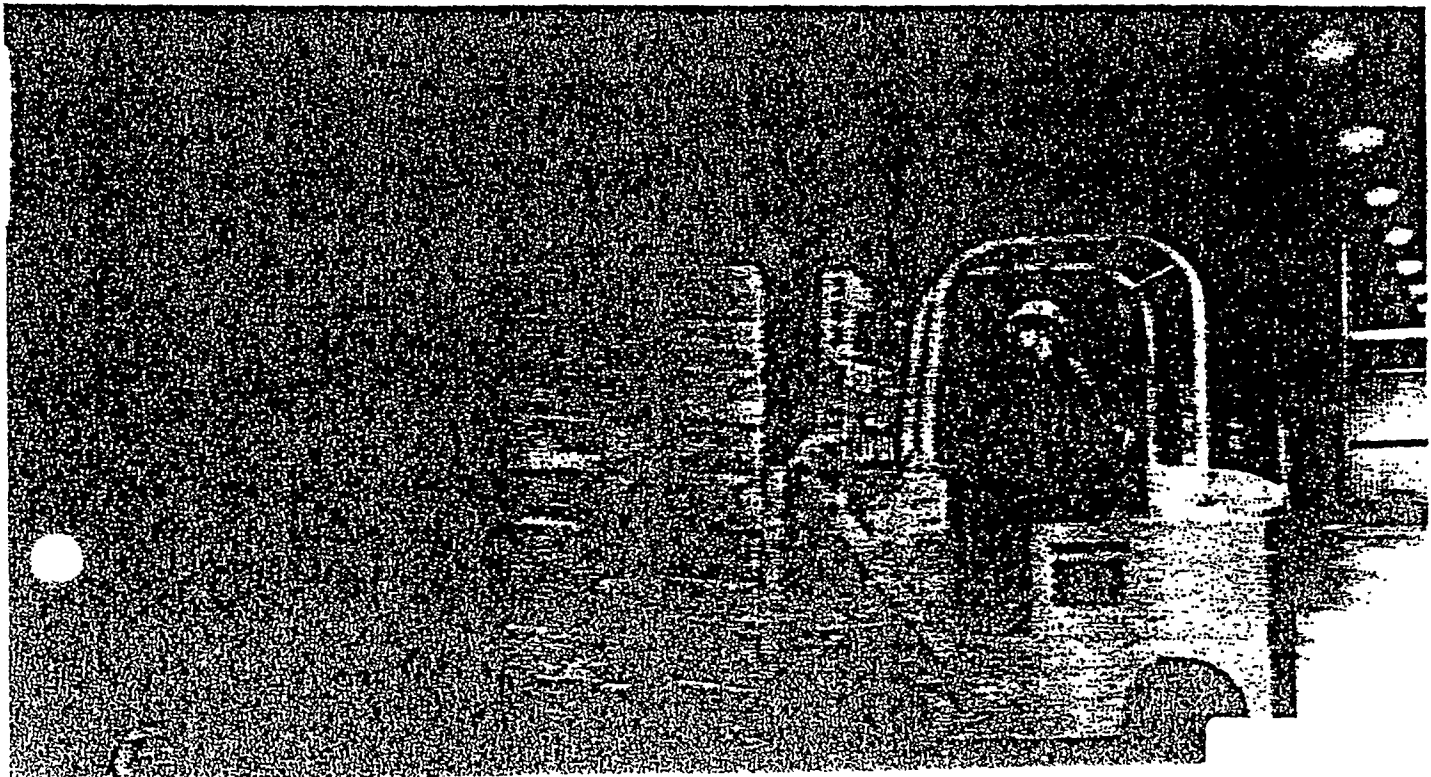
(left to right):
pressure-packed paper,
jute and polyethylene;
loose valve paper
and loose jute

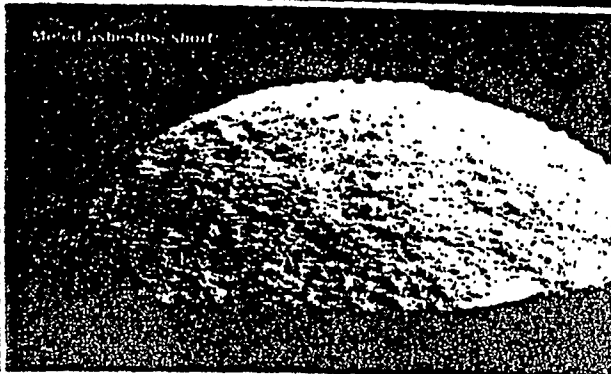
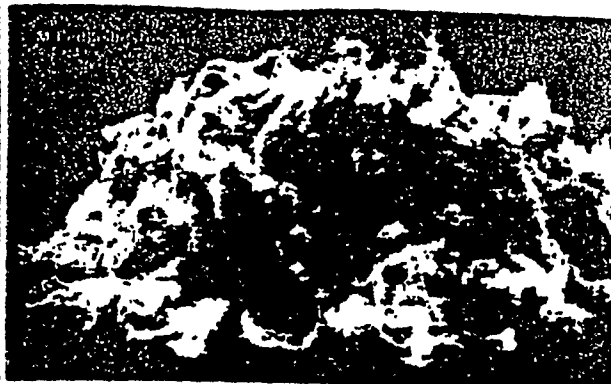


Many users prefer the standard pressure-packed multi-ply paper bag which is economical to warehouse and suited to mechanical handling. Various J-M grades are also available in a variety of bags, including: jute, valve-paper, and polyethylene.

Johns-Manville engineers constantly evaluate packaging and shipping methods to make sure that orders are delivered intact and in a form that takes full advantage of current freight rates and unloading equipment. Where circumstances preclude the use of a standard loading system, special patterns are worked out to suit individual cases.

Loading pressure-packed unit





All Canadian asbestos is divided into two classes, namely Crude Asbestos and Milled Asbestos.

CRUDE ASBESTOS

The name "crude" is applied to hand selected, cross-vein material, essentially in its native or unfiberized state, which requires mechanical treatment to reduce it to a usable form. It is subdivided into groups according to length.

ASBESTOS FIBER CLASSIFICATION

MILLED ASBESTOS

Initial classification of milled asbestos fiber is according to length distribution as determined by the Quebec Standard Screen Test. Within each standard grade designation there are several textural variations dependent on the degree of milling given the fiber and on different milling techniques. Grades containing a large number of spicules, or unopened fiber bundles are considered to be "crudy" while those in which the fiber bundles have been well subdivided or fiberized, are known as "opened" grades.

In the J-M system of nomenclature, the suffix following the standard grade designation identifies the texture. The following table gives a general outline of this system.

QUEBEC STANDARD GRADING SYSTEM

Group 1
Group 2

No. 1 Crude Consists basically of crude $\frac{3}{4}$ " staple and longer.
No. 2 Crude Consists basically of crude $\frac{3}{4}$ " staple up to $\frac{3}{4}$ ".

Group 3

Group 4

Group 5

Group 6

Group 7

Group 7
(floats)

Group 8

Group 9

Grade	Length	Width	Thickness	Weight	Grade	Length	Width	Thickness	Weight
3F	18.5	3.9	1.3	0.3	3F12				
3K	7	7	1.5	0.5	3K12				
3R	4	7	4	1	3R12				
3F	2	8	4	2	3T12				
3Z	1	9	4	2	3Z12				
4A	9	8	6	2	4A12				
4B	6	7	6	3	4B12				
4H	6	5	8	3	4H28				
4K	6	4	9	3	4K30				
4T	6	2	10	4	4T38				
5B	6	0.5	10.5	9	5D12				4T04
5K	6	0	12	4	5K38				5D04
5R	6	0	10	8	5R38				5R04
6B	6	6	7	9	6B38				6D04
7B	6	0	5	11					
7D	6	0	5	11	7D04				7D15
7F	6	0	4	12	7F04				7F15
7H	6	0	3	13	7H04				7H15
7K	6	0	2	14	7K04				7K15
7M	6	0	1	15	7M04				7M15
7R	6	0	0	16	7R04				7R15
7T	6	0	0	16	7T04				7T15
7R	6	0	0	16	7R15				7R15
7T	6	0	0	16	7T15				7T15
8B	6	0	0	16	8B15				8B15
8T	6	0	0	16	8T15				8T15
9B	6	0	0	16	9B15				9B15

In addition to the Standard Grades shown above, J-M has developed Special Grades for use in certain applications.

These include Plastibest #20, Paperbestos, and Asbaltic fibers, from the Jeffrey Mine, for use in the plastics, paper, and asphalt paving industries respectively; A-25 from Advocate Mine and M-60 and M-100 from the Munro Mine, for use in asbestos cement products; Ultrabestos grades from the Coalinga Mine, for use in floor tile; as well as many others.

If the Standard Grades do not fill your needs, you can arrange with your J-M Representative to have Johns-Manville develop a grade, custom tailored for your application.

SPECIAL J-M GRADES

MAJOR PHYSICAL AND CHEMICAL PROPERTIES OF ASBESTOS			
Grade	Length	Width	Thickness
10B	6	0	0
10T	6	0	0
11B	6	0	0
11T	6	0	0
12B	6	0	0
12T	6	0	0
13B	6	0	0
13T	6	0	0
14B	6	0	0
14T	6	0	0
15B	6	0	0
15T	6	0	0
16B	6	0	0
16T	6	0	0
17B	6	0	0
17T	6	0	0
18B	6	0	0
18T	6	0	0
19B	6	0	0
19T	6	0	0
20B	6	0	0
20T	6	0	0
21B	6	0	0
21T	6	0	0
22B	6	0	0
22T	6	0	0
23B	6	0	0
23T	6	0	0
24B	6	0	0
24T	6	0	0
25B	6	0	0
25T	6	0	0
26B	6	0	0
26T	6	0	0
27B	6	0	0
27T	6	0	0
28B	6	0	0
28T	6	0	0
29B	6	0	0
29T	6	0	0
30B	6	0	0
30T	6	0	0
31B	6	0	0
31T	6	0	0
32B	6	0	0
32T	6	0	0
33B	6	0	0
33T	6	0	0
34B	6	0	0
34T	6	0	0
35B	6	0	0
35T	6	0	0
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38T	6	0	0
39B	6	0	0
39T	6	0	0
40B	6	0	0
40T	6	0	0
41B	6	0	0
41T	6	0	0
42B	6	0	0
42T	6	0	0
43B	6	0	0
43T	6	0	0
44B	6	0	0
44T	6	0	0
45B	6	0	0
45T	6	0	0
46B	6	0	0
46T	6	0	0
47B	6	0	0
47T	6	0	0
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100B	6	0	0
100T	6	0	0

Grade	Length	Width	Thickness	Weight	Grade	Length	Width	Thickness	Weight
10B	6	0	0	16	10B15				
10T	6	0	0	16	10T15				
11B	6	0	0	16	11B15				
11T	6	0	0	16	11T15				
12B	6	0	0	16	12B15				
12T	6	0	0	16	12T15				
13B	6	0	0	16	13B15				
13T	6	0	0	16	13T15				
14B	6	0	0	16	14B15				
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63B	6	0	0	16	63B15				
63T	6	0	0	16	63T15				

TYPICAL ASBESTOS FIBER APPLICATIONS

Listed below are a few of the major areas for asbestos fiber, and some typical fiber grades used. For specific applications, see your J-M representative. On many applications, detailed technical bulletins are available.

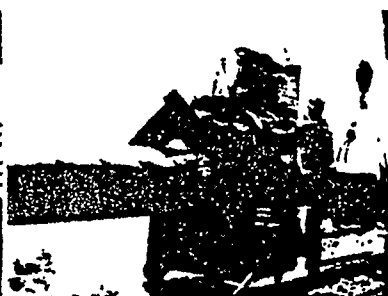
Acetylene Cylinders
4T04
Acoustical Plaster
7M05, 7H05
Adhesives
7M05, 7T05

Cements—Joint
7RF1, 7TF1
Chlorine Cells
3T12, 4T12, 4D12
Plastics (Reinforcement)
Plastibest #20, 7D28

Sprayed Insulation
5D12, 7M05
Welding Rods
7R05



Asbestos Cement Products
4T30, 6D30



Asphalt Coatings and Cements
7MF5, 7T05



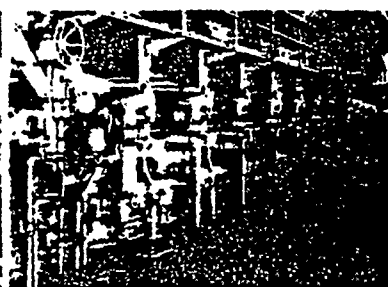
Asphalt Paving
Asphaltic Asbestos



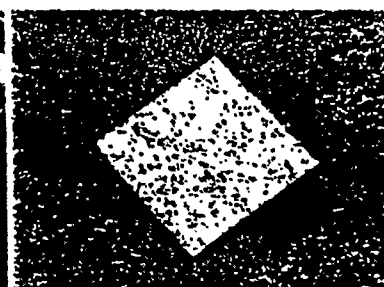
Caulking Compounds
7M15, 7TF1



Cements—Insulating
7M15



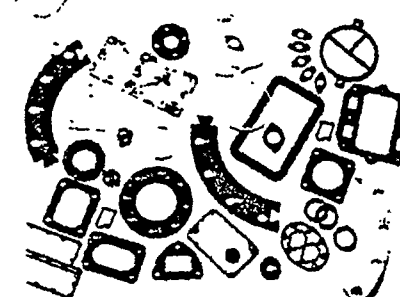
Paper
5K04, 7D04



Floor Tile
7TS6



Friction Materials
5R21, 7D24



Gaskets
4T04



Plastics (Filler)
7T15, 7TF1



Textiles
3R12, 3T12



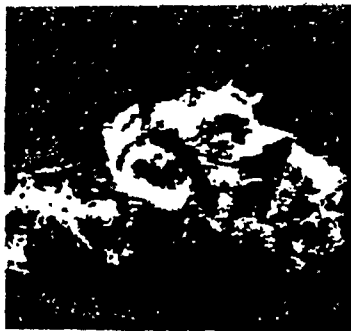
Texture Paints
7RF1, 7TF1

Temp. °F	% of Loss in Weight Strength
400	0.33
600	0.56
700	1.78
800	2.17
900	2.33
1000	3.99
1100	10.26
1200	12.75
1400	13.43
1600	13.52
1800	13.77

*Time: 2 hours

Original Strength (lb./sq. in.)	Residual Strength
100,000	91.5
100,000	73.3
100,000	59.3
100,000	32.9

Type of Fiber	Approximate Tensile Strength (lb./sq. in.)	Fibers in One Linear In.
Woolen Fiber	60,000	630
Woolen	60,000	1,015
Wool	60,000 to 80,000	910-1,250
Cotton	60,000	2,500
Rayon	60,000	3,300
Nylon	60,000	3,300
Glass	60,000	3,300
Rock Wool	60,000 to 80,000	3,520-7,040
Asbestos (Chrysotile)	60,000 to 80,000	850,000-1,400,000



JOHNS-MANVILLE



JOHNS-MANVILLE ASBESTOS FIBRE DIVISION

REGIONAL U.S. SALES OFFICE

Johns-Manville Research & Engineering Center
Asbestos Fibre Division Sales
Manville, New Jersey
Phone: 201-RA 2-9000

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JOHNS-MANVILLE
RESEARCH & ENGINEERING CENTER

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June 18, 1970

Mr. J. E. Stonis
Manager, Market Research & Sales Development
The C. P. Hall Company of Illinois
7300 S. Central Avenue
Chicago, Illinois 60638

Dear Mr. Stonis:

Don Partridge has referred your letter of May 28, 1970 to me for reply.

It has long been recognized that asbestos fiber, inhaled in large quantities over a long period of time, can be hazardous to health. Protection against this hazard can be achieved by maintaining the asbestos fiber dust concentrations in the workplace below the established Threshold Limit Value. Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect. TLV's are set by the American Conference of Governmental Industrial Hygienists, assisted by the Bureau of Occupational Safety and Health of the Department of Health, Education and Welfare. The presently proposed TLV for asbestos fiber dust is 5 fibers over 5 microns in length, per milliliter of air.

Maintenance of the dust concentrations below the Threshold Limit requires processes and handling methods that do not generate excessive dust, or, if they do, that properly designed mechanical dust control systems be provided. Good housekeeping practices are also essential in maintaining proper dust levels.

If dust concentrations cannot be maintained below the TLV, then exposed workers should wear respirators approved by the U.S. Bureau of Mines for protection against hazardous dusts. The latest Bureau of Mines approval schedule for such respirators is 21-B.

For your further information on the general subject of asbestos and health, I enclose the following papers that have been prepared by Johns-Manville:

"Asbestos and Human Health"
"Asbestos and the General Public"
"Asbestos--A Family of Minerals".

Mr. J. E. Stonis

-2-

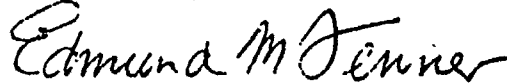
June 18, 1970

I also enclose a pamphlet prepared by the National Insulation Manufacturers Association on recommended health safety practices for handling and applying thermal insulation products containing asbestos. I am sure that some of the suggestions in this pamphlet would be applicable to your operations.

As you are undoubtedly well aware, there are in daily use throughout industry many materials that are potentially hazardous and toxic. Methods and techniques are available by which these materials, including asbestos fiber, may be handled safely.

Please contact me directly if you have additional questions.

Very truly yours,



Edmund M. Fenner, Director
Environmental Control

EMF/ems

Enc. (4)

ASBESTOS AND HUMAN HEALTH

INTRODUCTION

Asbestos, known since antiquity, has wide-spread and important applications in our modern industrial society. With the 20th century burgeoning of the uses of asbestos has come recognition of the need to cope with occupational hazards associated with excessive inhalation of asbestos dust. This statement summarizes the essential uses of asbestos, the known facts about health problems associated with occupational exposure to asbestos dust, and the research being conducted to identify and reduce these health risks.

AN ESSENTIAL PRODUCT

Asbestos has many essential functions in construction, in industry and in transportation. Over the years fireproof asbestos has saved thousands of lives and much valuable property. For safety, fire prevention and other reasons, products containing asbestos are used in schools, houses, theaters, ships, office and other public buildings, furnaces, boilers and firefighting equipment. The brakes on automobiles, trucks, buses and trains are dependable because asbestos is a major component of brake linings.

WHAT IS ASBESTOS?

Asbestos (from the Greek "unquenched") is the name given a family of mineral fibers comprised of three major types --- chrysotile, crocidolite and amosite --- each of which differs from the other; physically and chemically. Studies of the relationship between asbestos and health are complicated by this diversity.

Chrysotile is a white magnesium silicate, can be attacked by acids, has a positive electrical charge, is flexible and not easily pulverized. Crocidolite is a blue ferrous sodium silicate, is acid-resistant, has a negative electrical charge, and is less flexible than chrysotile. Amosite is a ferrous magnesium silicate with a negative electrical charge, is brittle and easily pulverized.

- 1 -

KNOWN AND SUSPECTED OCCUPATIONAL RISKS

For workers who handle asbestos fibers in mines, mills, factories, and some building and insulation trades, the industry shares with doctors, public health officials and others involved in industrial medicine a concern about possible health effects from excessive on-the-job exposure to asbestos dust.

ASBESTOSIS: The industry long ago recognized the risk of a particular lung disease called asbestosis among some workers and took steps to safeguard employees. This non-malignant disease is brought on after inhalation of excessive concentrations of asbestos dust over a period of many years.

Asbestosis is one of the lung diseases called pneumoconioses. Others are silicosis, from silica (stone) dust; talcosis from talc; anthracosis, from coal dust. These are considered industrial health risks against which the various industries have instituted protective measures.

For years, the asbestos industry has taken protective measures to reduce excessive exposures to asbestos dust and the risk of asbestosis among its workers.

BRONCHOGENIC (Lung) CANCER: The industry is aware of some medical studies that have reported an association between excessive exposure to asbestos dust and an increased risk of a certain type of lung cancer (bronchogenic). Even though the number of these cases among asbestos industry workers is only a small fraction of the total employed, the industry considers the problem a serious one. It has become the subject of considerable scientific research through statistical, clinical and pathological studies of exposed workers; through experimental studies with laboratory animals; and through studies of the physical and chemical nature of asbestos and associated minerals. Recent studies have suggested that the trace metals often found with asbestos dust (nickel, cobalt and chrome) should be examined more closely.

In 1967, results of a study of deaths occurring among a group of insulation workers indicated that occupational exposure to asbestos greatly increased the risk of lung cancer but only among cigarette smokers. Although the number of deaths involved was small, the study showed no cases of lung cancer among insulation workers who were non-smokers.

MESOTHELIOMA: Also under study is a rare disease called mesothelioma, a tumor of the chest and abdominal cavity which is different from bronchogenic lung cancer. Recently, investigators have associated a frequency of cases of mesothelioma with exposure to asbestos in certain geographic locations. This was originally

for research of such organizations as: The Industrial Hygiene Foundation of America, The Asbestosis Research Council (headquartered in Great Britain), The Institute of Occupational and Environmental Health in Montreal, The Environmental Health Center at Mt. Sinai Hospital and others. Johns-Manville also conducts studies on technical aspects of asbestos in its own Research and Engineering Center at Manville, New Jersey.

Among the subjects scientists are now exploring are: the specific identification and health significance of fiber-like (ferruginous) bodies found in lung tissues; the health of asbestos mining, processing and fabricating workers compared with the general population; the relationship between cigarette smoking and cancer among asbestos insulation workers; the accurate identification of particles found in the air over a major industrial city; and the development and evaluation of the most effective industrial hygiene practices for use in the asbestos industry.

In cooperation and in conjunction with other agencies, the asbestos industry will continue to seek new information about the biological effects of asbestos fiber and to develop ways of assuring maximum possible protection from occupational hazards, for its employees in asbestos mines, mills and plants and among fabricators and applicators of this essential material.

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January 15, 1968

September 16, 1968

ASBESTOS AND THE GENERAL PUBLIC

People of virtually every nation in the world benefit from the many uses of the mineral, asbestos. Asbestos helps to build safety and durability into schools, houses, ships, aircraft and public buildings.

With the increasing use of this mineral fiber, the question has been raised as to whether asbestos, especially when suspended in city air, poses any health risk to the general public. The same question is being asked about many other materials in general use in our modern society. Medical and scientific research is being conducted to find answers. For asbestos, some of the answers are already in.

To the extent that any asbestos fibers are in the general air -- and there are literally hundreds of different animal, vegetable and mineral fibers in the dust of the air -- there is nothing to show that these are a health hazard for the public.

To see why this is so requires understanding of how and why asbestos is used, of some of the scientific research that has been conducted, and of the meaning of this research with regard specifically to those with occupational exposures in contrast to the general public.

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MODERN USES GROW OUT OF ANCIENT KNOWLEDGE

The word asbestos is from the Greek; it means "unquenched" or "incombustible." The peculiar properties of asbestos have fascinated people ever since the mineral was discovered more than 4,500 years ago. Although in the raw state it is as dense and compact as the rock which encases it, asbestos can be separated into light, silky fibers. These fibers have many uses. They can be woven into non-combustible fabrics for such things as fire curtains for theaters or protective garments for firefighters. They can be added to other materials to produce floor and ceiling tile, roofing shingles, siding, asbestos-cement pipe and many other useful products.

The earliest known use of asbestos goes back 45 centuries. Objects unearthed by archeologists in Finland indicate that it was used to hold together pieces of pottery before the clay was baked.

According to legend, the Emperor Charlemagne owned a "magic" asbestos table cloth which his stewards cleaned after royal banquets by throwing it into a fire, then retrieving it intact. Marco Polo found asbestos cloth on his journey to Asia and was told that it was woven from a salamander skin, but he later learned its true origin.

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MINERAL PROVIDES SAFETY AND DURABILITY

In the twentieth century, asbestos has become an increasingly essential material of an improved way of life and an expanding industrial economy. Asbestos has many vital functions in construction, transportation and industrial processes. It provides built-in protection against fire and deterioration in scores of common products in daily use. Through the years it has saved countless lives and billions of dollars in property damage by preventing or checking the spread of fires. Electrical installations are safer because of asbestos insulation. When used as packings and gaskets, asbestos promotes the efficient operation of industrial machines and pumps.

In transportation, the brakes on vehicles -- cars, trucks, buses and trains -- are dependable because asbestos is a chief component in brake linings.

OCCUPATIONAL RISKS AND STEPS TO PROTECT WORKERS

To meet the increasing demand for this invaluable fiber, a worldwide asbestos mining and processing industry came into being.

As in many other mineral and materials industries, the need developed to protect employees against occupational health hazards.

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It was found that some workers exposed to excessive asbestos dust over a period of years developed a non-malignant lung disease called "asbestosis." As with many similar conditions, asbestosis is dose-and-time related -- that is, it develops only after inhalation of excessive concentrations of asbestos dust over a period that averages 17 years.

Some medical studies have reported an association between the disease "asbestosis" and an increased risk of a certain type of lung cancer (bronchogenic). Even though the number of lung cancer cases among workers heavily exposed to asbestos fiber is only a small fraction of the total employed, the industry considers the problem serious. It is the subject of considerable scientific research through statistical, clinical and pathological studies of exposed workers; through experimental studies with laboratory animals, and through studies of the physical and chemical nature of asbestos and associated minerals.

In the recent past, the asbestos industry has invested millions of dollars in equipment and techniques to prevent the inhalation of asbestos dust by workers in the mining and milling of asbestos and in the manufacture of asbestos-containing products. A program of education and training is conducted for asbestos fabricators and applicators to provide them with a thorough understanding of potential risks and to encourage general adherence to sound industrial hygiene practices.

Studies in asbestos-using industries in England and the United States indicate that where dust control measures have been taken, the risk of lung diseases among the workers has been greatly reduced.

NO RISKS TO GENERAL PUBLIC SHOWN IN STUDIES

Because of the occupational health hazards associated with asbestos, some people who are concerned about general air pollution have raised the question of whether there is asbestos dust in the air in sufficient quantities to constitute a health risk to the general public.

Studies of asbestos exposure and human health of the general public have produced no evidence of any health hazard to the general public from the use of finished asbestos products. "Asbestosis" does not occur among the general population; it occurs only among those with long-time, heavy occupational exposures. There is no evidence that anyone has ever contracted any disease from exposure to the wearing or weathering of brake linings, floor tile, roofing, or other products containing asbestos.

Brake linings in particular were the subject of a 1968 United States Public Health Service report. Jeremiah Lynch of the National Center for Urban and Industrial Health, U. S. Public Health Service, conducted the tests. He concluded that any asbestos that might come from brake lining wear was "an inconsequential health

factor in urban air pollution." The study provided scientific evidence refuting much recent unsupported speculation that the wear of brake linings might be releasing many asbestos fibers into the air:

"Except in all but the most extreme driving conditions, only a very small fraction of the 30 to 50% asbestos present in a brake lining escapes into the atmosphere as free fiber ... the remainder is converted into some other mineral as a result of the extreme temperatures generated at small spots on the lining surface. Thus, although urban air contains a few free fibers as a result of brake lining wear, they represent a very small proportion of the total asbestos used in the manufacture of brakes. Many sources of respirable fibers not associated with asbestos products have been identified, and the free fibers from brake lining wear appear to be an inconsequential health factor in urban air pollution."

Other medical and scientific reports show that the occupational health risks from asbestos dust exposure do not extend to the public.

In 1967 Drs. P. E. Enterline and M. A. Kendrick reported on the reduction of asbestosis among workers in asbestos fabrication in industries where protective measures have been taken. They pointed out that the small amount of asbestos to which people in general may be exposed is of "little importance:"

"..... if very low-level exposures of populations to asbestos dust play any part in the pathogenesis (development) of disease it must be very small indeed Asbestos dust at levels to which general populations are exposed probably is of little importance in the etiology (causation) of disease."

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SO-CALLED "ASBESTOS BODIES" NOT RELATED TO DISEASE

In the mid-1960's the question of public exposure was discussed in studies that reported finding so-called "asbestos bodies" in the autopsied lungs of some city dwellers who were not known to have been exposed directly to asbestos dust. The studies emphasized that these so-called "asbestos bodies" had no relation with either the cause of death or with any history or symptoms of pulmonary disease.

The authors of one such study, Drs. J. G. Thomson and W. M. Graves, noted that it would have taken a tremendous increase in the number of "asbestos bodies" found in the autopsied lungs to constitute even a "minimal" case of asbestosis. They said in their 1966 report:

"It should be stressed that in spite of frequent asbestos bodies in the lung bases none of this group had pulmonary disability and all died from other causes to convert the scanty or very scanty bodies which we have demonstrated to be present in so many urban dwellers to the frequency present in a minimal basal asbestosis would require an increase by hundredfolds and to get a more diffuse classical asbestosis with pulmonary disability the multiplying factor might well be in many millions."

In a similar study the same year, Drs. L. Anjilvel and W. M. Thurlbeck noted that there is no risk of cancer to the general population from asbestos exposure. These researchers said:

"In our series there seemed to be no particular association between malignancy and the presence of asbestos bodies ... asbestos bodies are not more common in patients with malignant disease in the autopsy populations we have

studied, and thus casual exposure to asbestos is not an important cause of malignancy in the general population."

Other authors have raised the question of the real identity of these so-called "asbestos bodies." The term has for years been applied loosely to describe a tiny body of tissue in the lung containing a core of some inhaled particle -- asbestos, talc, man-made fiber, or certain other common substances. The name "asbestos body" is misleading if the core substance has not been positively identified. Thus, it is not necessarily so that the finding of such "bodies" in city dwellers' lungs means that these people inhaled asbestos.

Because the cores of such "bodies" do not always contain asbestos, and because the over-growth tissue contains some identifiable iron, Dr. Paul Gross, who has studied the problem extensively, has suggested that a more accurate name would be "ferruginous (iron-like) bodies." Other specialists have now begun to refer to "ferruginous bodies" in their papers.

Dr. J. M. G. Davis, in 1967, deplored the "current furor over asbestos bodies --- which recently appeared in the professional literature and was widely reported in the news media with varying degrees of sensationalism." He commented specifically:

"..... the basic assumption that asbestos-like bodies can only be produced from asbestos has proved incorrect and this casts considerable doubt on the theory that has been the chief basis of the asbestos 'scare'."

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MANY THINGS BESIDES ASBESTOS MAY CAUSE FIBROUS "BODIES"

Much research work is going on to develop ways of identifying the particles that may be the core of these "bodies." It has been shown that a number of substances can cause "bodies" in both humans and experimental animals. L. J. Cralley and associates in the U. S. Public Health Service have discussed the great number of substances which might produce "bodies" in human lungs. Publishing in 1968, they said:

"On the premise that the fibrous bodies observed in the lungs of persons at autopsy are all "asbestos bodies" and that coated fibrous bodies are a specific reaction to asbestos fibers, some investigators have concluded that asbestos fibers are significant air contaminants ... Respirable fibers may be mineral, vegetable or animal in origin and may come from both natural and synthetic sources. There are well over a hundred different natural minerals with some degree of fibrous structure Respirable fibers of vegetable origin may be from both live and dead plant tissues Animal fibrous materials include animal hair and scale, insect hair ... Synthetic fibers include the newer ceramic fibers ... as well as a wide range of established and emerging organic types used in textiles, fillers, containers, filaments, structural materials, etc."

Whatever their origin, the "bodies" that have been reported have not been connected with any disease, or with the cause of death, in the subjects studied. Even if some asbestos is among the variety of fibers in the air breathed by the public there is no evidence that it has any health significance.

SUMMARY

People throughout the world benefit from the many uses of

asbestos -- in schools, houses, theaters, ships, aircraft, offices and other public buildings, furnances, boilers, firefighting equipment and in a myriad of everyday products.

With the 20th century growth in the use of asbestos has come recognition of the need to cope with occupational hazards associated with excessive inhalation of asbestos dust. Much progress has been and is being made in protecting workers who handle asbestos fibers in mines, mills, factories and in some building and insulation trades.

Medical scientists studying the occupational health hazards of asbestos see no evidence that asbestos poses any risk to the general public. Asbestos dust is not present in the general air in amounts of any significance to human health.

PERSPECTIVE

It is important to view in its proper perspective the expressed concern of some people that asbestos in the ambient air is a health risk to the general public.

Asbestos is by no means alone in having the finger pointed toward it as a possible health hazard. Literally hundreds of substances -- as common and everyday as fuel oil, charcoal broiled steaks, iron rust and egg yolks -- are known or suspected of being cancer causing agents under certain experimental conditions.

(Moral

The point is that nearly everything we use and create in our increasingly complex society has been suspected, by someone, of being a potential hazard.

To forego the many benefits of these products of modern technology -- simply on the basis of suspicions that are unsupported by medical evidence, would be a great and unwarranted disservice to the American public.

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July 1, 1968

ASBESTOS - - A FAMILY OF MINERALS

SUMMARY:

This paper sets forth some of the reasons why the term "asbestos" should not be used loosely in discussing medical questions.

There is no single mineral known as asbestos. "Asbestos" is a name given to a family of minerals. It includes two major groups, containing a total of six varieties of asbestos. Each of these six differs from the others, physically, chemically and in biological effect. Any study of the effects of asbestos is complicated by this diversity.

Studies of both people and animals show differing types of reaction to the various types of asbestos. Animal studies of excessive exposure indicate that of the three major commercial types of asbestos, commonly used chrysotile is least likely to produce a reaction.

Because different varieties of asbestos produce different reactions, scientists are working on better methods for identifying the types of asbestos involved in their studies on human health. Other complications arise because trace amounts of mineral impurities are often found in samples of raw asbestos ore and refined fiber.

VARIOUS TYPES OF ASBESTOS

Any attempt to assess the effect of asbestos on health is complicated by the fact that asbestos is not a single chemical or physical entity. "Asbestos" is a generic name given to a group of hydrated silicate minerals that have one common attribute, namely, the ability to be separated into relatively soft, silky fibers.

The known varieties of these minerals can be divided into two main classes on the basis of their crystal structures: serpentine asbestos and amphibole asbestos. The lone member of the serpentine class is chrysotile asbestos, which is by far the most common of the asbestos minerals. About 95 per cent of the asbestos used in this country is chrysotile, principally from mines in Canada.

There are five recognized varieties of amphibole asbestos: crocidolite, amosite, anthophyllite, tremolite and actinolite. Of the amphiboles, crocidolite and amosite have the greatest commercial significance, although the use of anthophyllite is increasing.

Each of the six types of asbestos differs from the others, chemically and physically. To add to the complexity, the chrysotile from one Canadian mine, for example, will differ in chemical impurities and in physical properties from the chrysotile from

CHARACTERISTICS OF THREE MAJOR TYPES

Each of the three types of asbestos that are most important commercially - - chrysotile, crocidolite and amosite - exhibits distinguishing characteristics.

CHRYBOTILE - By far the leading producers are Canada and the Soviet Union. Smaller deposits are found in South Africa, Rhodesia, China, the United States and Italy. Chrysotile is a white serpentine asbestos and occurs in areas where serpentine rock was cracked by earth movement long ago and subjected to intense pressure and volcanic waters. This transformed some of the granular serpentine into fibrous chrysotile. Chemically, chrysotile is hydrous magnesium silicate with a magnesium hydroxide surface. It has a positive electrical charge. It can be attacked by acids. It is a flexible fiber and does not pulverize readily. Commercial fibers contain small and varying amounts of iron and calcium compounds, depending upon origin.

CROCIDOLITE - The bulk of the world's supply comes from South Africa. There are also small deposits in Australia, but they are no longer being mined commercially. It is an amphibole asbestos occurring in iron-rich sedimentary rock. Chemically, crocidolite is a ferrous sodium silicate with a silica surface. It has a negative electrical charge.

It is acid-resistant. It is characterized by a deep blue color. Crocidolite is less flexible than chrysotile.

AMOSITE - The Transvaal district of South Africa is the only place where amosite is mined commercially. It is a member of the amphibole asbestos family, occurs in the same type of rock as does crocidolite, and has the same negative electrical charge, but is brown in color. Chemically, amosite is a ferrous magnesium silicate with a silica surface. It is also acid-resistant, but less so than crocidolite. It is brittle and pulverizes easily.

The major characteristics of these three types of asbestos are summarized in a table attached to this paper.

Because of the basic chemical and physical differences between chrysotile, crocidolite and amosite, it would be expected that overexposure to the three varieties would show varying biological effects. Scientific observation confirms this expectation. There seems to be broad agreement that chrysotile, the type of asbestos most heavily used in the United States, is least likely to produce asbestosis, a non-malignant lung disease brought on after inhalation of excessive concentrations of asbestos dust over a period of many years.

ANIMAL EXPERIMENTS SHOW DIFFERENT EFFECTS

Dr. J. C. Wagner experimented with all three types of asbestos on various laboratory animals, and found that crocidolite produced the most severe asbestosis and that amosite was more than five times as likely to produce a reaction as chrysotile. He reported, in 1963:

"With chrysotile dust it was possible to produce severe lesions in the lungs of guinea-pigs, slight fibrosis in monkeys, while no significant effect was observed in two rabbits. Amosite dust causes marked asbestosis in all three kinds of animals. Lesions occur more rapidly in guinea-pigs exposed to this dust than in those exposed to chrysotile. There is an indication that the disease is progressive in monkeys and rabbits. Similar pathology to that which occurred in a monkey exposed to chrysotile for 22 months was observed in a monkey exposed to amosite for four months. The impure crocidolite dust caused severe disease in guinea-pigs, and the rate of respiratory infection among animals exposed to this dust was more marked than with the other types. It is possible that this may be due to the high quartz content of the dust.

"Finally, asbestos bodies could be demonstrated in the lungs of animals exposed to all three types of asbestos dust. These were scanty in the animals exposed to chrysotile and usually segmented. Only occasional fibers were observed. In contrast to this, the asbestos bodies in the animals that were dusted with amosite were plentiful, and segmentation was rare: fibres were extremely numerous and far outnumbered the bodies."

Following further investigation, Dr. Wagner offered an explanation for this observation at a medical symposium in 1965:

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"A method of producing asbestos dust clouds has been devised and an animal inhalation experiment carried out to test it The elimination rate of Rhodesian chrysotile has been found to be three times greater than that of the amosite and crocidolite, which suggests an explanation for the previously observed reduced fibrogenicity of this dust. The reason for the difference in the elimination rate remains to be determined."

COMMERCIAL ASBESTOS CONTAINS OTHER MATERIALS

Asbestos ore and refined asbestos fiber contain mineral impurities, trace elements, and trace quantities of organics, which vary from type to type and from mine to mine. In transit the ore may pick up additional trace organic impurities.

These trace materials are also the subjects of medical study to see if they may have a role in any of the health effects observed in animals. Trace impurities of nickel, chromium and manganese for example, were found by Dr. L. J. Cralley and associates in samples of chrysotile used in the asbestos textile industry. Other impurities in commercial asbestos fiber include iron, aluminum, calcium, sodium and potassium.

WORLD ASBESTOS BANK

Much scientific research has focused on studying the varying biological effects of different types of asbestos and on developing techniques for identifying asbestos fibers of unknown origin. In 1967 a "World Asbestos Bank" was established in Johannesburg, South

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South Africa, under the direction of the British Medical Research Council. The purpose of the "bank" is to provide standardized samples of asbestos from regions all over the world to be supplied to medical researchers for chemical, physical and biological investigation and for comparison purposes in clinical studies.

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T A B L E

CHARACTERISTICS OF MAJOR COMMERCIAL TYPES OF ASBESTOS

NAME	Chrysotile	Crocidolite	Amosite
CLASS	Serpentine	Amphibole	Amphibole
COLOR	White	Blue	Brown
CHEMICAL COMPOSITION	Hydrous Magnesium Silicate	Ferrous Sodium Silicate	Ferrous Magnesium Silicate
SURFACE COMPOSITION	Magnesium Hydroxide	Silica	Silica
ELECTRICAL CHARGE	Positive	Negative	Negative
REACTION TO ACID	Susceptible	Resistant	Resistant
TEXTURE	Flexible	Medium Flexibility	Brittle

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Asbestos and Health

INTRODUCTION

Asbestos, known since antiquity, has widespread and important applications in our modern industrial society. The increased use of asbestos in the 20th century has led to recognition of the need to augment the efforts to cope with occupational hazards associated with the inhalation of excessive amounts of asbestos dust. This paper summarizes the essential uses of asbestos, the known facts about health problems associated with occupational exposure to asbestos dust, and the research being conducted to identify and reduce these health risks.

ASBESTOS—AN ESSENTIAL PRODUCT

Asbestos has many essential functions in construction, in industry and in transportation. Over the years fire-resistant asbestos has saved thousands of lives and much valuable property. For safety, fire prevention and durability, products containing asbestos are used in schools, houses, theaters, office and other public buildings, spacecraft, furnaces, boilers and firefighting equipment. The brakes on automobiles, trucks, buses and trains are dependable because asbestos is a major component of brake linings.

WHAT IS ASBESTOS?

Asbestos is the name given a family of mineral fibers, including four commercially significant varieties—**chrysotile**, **crocidolite**, **amosite** and **anthophyllite**—each of which differs from the others, physically and chemically. Studies of the relationship between asbestos and health demonstrate the importance of these differences.¹

These mineral fibers can be divided into two main classes on the basis of their crystalline structures: serpentine asbestos and amphibole asbestos. **Chrysotile**, a flexible white magnesium silicate which can be attacked by acids, and which is the only fiber that carries a positive charge in water, is the lone member of the serpentine class. It has one major difference from the other asbestos minerals; it's generally curly rather than straight and because it is flexible it can be bent into a "U" shape. These characteristics mean that this fiber does not penetrate as deeply into the lung as do the other varieties. The other commercially significant varieties are all amphiboles. **Crocidolite** is a blue

ferrous sodium silicate which is acid resistant and less flexible than chrysotile. **Amosite** is a brown ferrous magnesium silicate which is brittle and easily pulverized. **Anthophyllite** is a white magnesium silicate which is brittle and acid resistant.

NO HEALTH RISKS FOR THE GENERAL PUBLIC

In this expanding industrial society, many substances and materials that could pose health and safety hazards to industrial workers under certain conditions do not, in their finished form, carry any risks to the public. This is the situation with asbestos fiber. Research in industry on asbestos exposure has shown that there are occupational health risks associated with on-the-job inhalation of excessive amounts of asbestos dust. Also, in some circumstances in the past, there has been risk to persons living in the immediate vicinity of factories using asbestos, and to members of families of wage earners who worked in occupational exposures and brought home excessive amounts of asbestos dust on their clothes.

However, there is no evidence either from experience or from scientific study that anyone in the general public has ever contracted any disease from exposure to the wearing or weathering of brake linings, floor tile, roofing, wall or ceiling panels, or similar asbestos-containing items.² In such products, the asbestos fibers are bound with cement, plastics or other binding materials, and are not released in significant amounts in normal use.

Studies of asbestos fiber concentrations in the public air have shown them to be very low—in the order of 1/100 (0.05 asbestos fibers per cubic centimeter of air) of the maximum allowable for occupational exposures (5 fibers per cc).

The application of automobile and truck brakes does not release significant quantities of asbestos fiber to the atmosphere. Only a small fraction of the asbestos in brakes is dispersed as fiber.⁴ The remainder is converted by the heat of brake application to a nonfibrous mineral, **forsterite**.

With increasing scientific interest in general air pollution problems, one of many questions being studied is whether city dwellers may be exposed to some asbestos fibers along with other dusts that are known to be in the ambient air. Further attention to this question was aroused by reports of the find-



ing of a scant number of so-called "ferruginous (iron-like) bodies" in the autopsied lungs of some city dwellers. These microscopic bodies are composed of protein and iron pigment deposited over specks of fibrous materials that may remain in the lungs. Urban dwellers are exposed to the dust of more than a hundred different types of fiber, other than asbestos, many of which can form the core of ferruginous bodies.

Similar bodies are also found in the lungs of workers who are exposed occupationally to asbestos fibers. In such cases, they are called "asbestos bodies." This term is sometimes still mistakenly used to designate a ferruginous body, even if the central core material has not been identified as an asbestos fiber.³

The number of ferruginous (asbestos) bodies found in people occupationally exposed is *many times greater* than the number found in the lungs of urban dwellers. It is important to remember that the presence of the few ferruginous bodies found in the various random autopsy studies of city dwellers had no connection with either the cause of death or with any history or symptoms of pulmonary disease among the subjects, but only reflected the chance inhalation of some fibrous material in the urban air.²

While research continues on the subject, the facts thus far strongly indicate that the sweeping inferences that have been made with regard to the possible dangers of public asbestos air pollution are unjustified.

KNOWN AND SUSPECTED OCCUPATIONAL RISKS

Asbestosis: The industry long ago recognized the risk of a particular lung disease called asbestosis among some workers and took steps to safeguard employees. This non-cancerous disease is brought on only after inhalation of heavy concentrations of asbestos dust generally over a period of many years.⁵

Asbestosis is one of the lung diseases classified as "pneumoconioses." Among others are silicosis, from crystalline silica dust; byssinosis from cotton dust; talcosis from talc; and anthracosis from coal dust. These are considered industrial health risks against which the various industries have developed protection for the worker.

For years, the asbestos industry has taken protective measures to reduce exposures to asbestos dust and reduce the risk of developing asbestosis among workers. Practices for handling asbestos fibers have been developed to minimize generation of dust. Complex dust suppression and control systems to prevent dissemination of dust are installed in many operations. Approved respirators are required for workers where dusts are unavoidable. When used properly, these measures have been shown to afford completely effective protection.

Bronchogenic (Lung) Cancer: A number of medical studies have reported an association between asbestosis and an increased risk of a certain type of lung cancer (bronchogenic). Although the number of these cases among asbestos industry workers is only a small fraction of the total employed, the industry considers the problem a serious one. It has become the subject of considerable scientific research through statistical, clinical and pathological studies of exposed workers; through experimental studies with laboratory animals; and through studies of the physical and chemical nature of asbestos and associated minerals. Among areas of investigation are the time-dose relationship; the effect of different varieties of asbestos; the effect of excessive asbestos inhalation combined with other factors such as cigarette smoking and co-existing trace metals.

The belief that asbestos fibers do not by themselves cause lung cancer was reinforced by a 1967 study indicating that exposure to asbestos among insulating workers greatly increased the risk of lung cancer but *only* among cigarette smokers. Among insulation workers who were nonsmokers, the study showed no more than the expected rate of lung cancer.⁶ This conclusion was re-confirmed by a study completed in 1972.⁷

Mesothelioma: Also under study is a rare disease called mesothelioma, a tumor of the chest and abdominal cavity which is different from bronchogenic lung cancer. Recently, investigators have associated an unusually high frequency of cases of mesothelioma with exposure to asbestos in certain geographic locations. This was originally reported from certain South African areas where only crocidolite asbestos is produced. However in another

crocidolite mining section of South Africa, several hundred miles away, only two mesotheliomas have been found, even though similar techniques for finding these tumors have been used. No mesotheliomas have been found among workers engaged in amosite mining and milling in South Africa. Conversely, cases have been found in employees of a New Jersey factory that in the mid-1940's was making insulation from amosite fiber. These situations have raised the question as to whether factors other than asbestos are involved.⁸

In the United States, mesothelioma is reported so seldom that there are no accurate figures on its occurrence in this country. In Britain, only two cases are currently reported for every thousand cases of lung cancer from all causes.⁹

The search for the cause of this unusual disease is hampered by the fact that its diagnosis and recognition is still considered a problem among medical experts. In several countries mesothelioma registries have been set up to try to collect case histories to learn more about the tumor. It is becoming increasingly obvious that there are circumstances other than exposure to asbestos fiber that can also cause mesothelioma.¹⁰⁻¹¹ The asbestos industry through research grants is assisting in medical efforts to gain more knowledge about this rare disease.

INDUSTRIAL HYGIENE AND PREVENTIVE MEDICINE

Today, the asbestos industry has invested millions of dollars in equipment and techniques to prevent the inhalation of asbestos dust by workers in the mining and milling of asbestos and in the manufacture of asbestos-containing products. Johns-Manville continually strives to eliminate dust exposure in the mines and plants which it operates. Processing areas and machinery are equipped with dust suppression and collection devices. Major improvements have been made in fiber shipping methods. For example, Johns-Manville has inaugurated the use of special railroad cars containing pallet loads of interlocked and glue-locked bags.

This procedure permits complete unloading by fork truck, eliminating manual handling of bags. Atmospheric dust levels are monitored regularly. Individual respirators are used where indicated. Employees are given physical examinations to

OSHA standards. A centralized Department of Environmental Control maintains constant surveillance over conditions in all J-M plants and mines.

Johns-Manville has also conducted a program of consultation with asbestos fabricators, applicators and trade groups such as the *Asbestos Textile Institute*, *Asbestos Cement Products Association*, *National Insulation Contractors Association*, and *Thermal Insulation Manufacturers Association* to provide a thorough understanding of potential risks and to encourage general adherence to sound industrial hygiene practices.

Before asbestos-containing fireproofing sprays were legislated out of existence, Johns-Manville voluntarily stopped selling asbestos fiber for this purpose. The company deemed this an improper use of asbestos because of the relative impossibility of effective dust control in the spraying technique used in the United States.

The company also participated in a major cooperative effort between labor, industry, science and government to conduct a health research program for industrial workers. The *Insulation Industry Hygiene Research Program*, jointly sponsored by a labor union, the International Association of Heat and Frost Insulators and Asbestos Workers, and by Johns-Manville Corporation, was organized in 1968 at the Mount Sinai School of Medicine in New York City to develop improved methods to minimize exposure of insulation workers—men who apply and remove pipe and equipment insulations in buildings, industrial plants and ships—to dust and fumes encountered in their work. The United States Public Health Service provided consultation and technical assistance.

Studies in asbestos-using industries in England and the United States indicate that where effective dust control measures have been taken, the risks of lung diseases have been reduced.²

ASBESTOS HEALTH RESEARCH

Research on the health effects of asbestos has been supported by Johns-Manville since the late 1920's. At the Saranac Lake, N.Y., laboratory of the Trudeau Foundation, then one of the leading research centers for pulmonary disease in the United States, the company sponsored a program of investigations designed to determine safe asbestos dust levels and to eliminate asbestosis among



workers in its mines and plants. For more than 20 years the company supported research in this laboratory, basing its continually improved dust control activities on the research findings.

Today, scientific research to "identify" and "reduce" the health risk from asbestos dust exposure is being conducted in many places throughout the world. The asbestos industry both sponsors such research and cooperates in work being done by government agencies and private medical investigators.

Johns-Manville has extended full cooperation to the U.S. Public Health Service in its 7 to 10 year study of workers employed in asbestos processing plants. This epidemiological study will assess the varying environmental factors affecting the health of more than 10,000 asbestos factory workers. In addition, the company provides funds, asbestos materials, equipment and information, as the individual situation may require, for research of such institutes as: The Industrial Health Foundation of America, The Institute of Occupational & Environmental Health, Mount Sinai School of Medicine, Tulane University, University of Pittsburgh, McGill University, St. Luke's Hospital, Cleveland, Ohio. Johns-Manville also conducts studies on technical aspects of asbestos in its own Research and Development Center in Denver, Colorado.*

In cooperation and in conjunction with other agencies, the asbestos industry will continue to seek new information about the biological effects of asbestos fiber and to develop ways of assuring maximum possible protection from occupational hazards for its employees in asbestos mines, mills and plants and among fabricators and applicators of this essential material.

EXPLANATORY NOTES

1. Because the major types of asbestos differ chemically and physically, they also differ in their biological effect on humans and in experimental animals. Current knowledge indicates that crocidolite, the type least used in the United States, is most clearly associated with health hazards for people. This is the consensus of a panel of nine medical experts appointed by the British Ministry of Labour—Christy, R. K. and members of the

panel, "Problems Arising from the Use of Asbestos," *Her Majesty's Stationery Office*, 1967.

Wagner published experimental evidence that compared with other asbestos fibers, crocidolite produces the most severe asbestosis in laboratory animals—Wagner, J. C., "Asbestosis in Experimental Animals," *British Journal of Industrial Medicine*, 1963, 20, 1.

Wagner et al., reported a high number of mesothelioma cases among crocidolite miners and millers in one area of South Africa, but no cases among amosite miners and millers—Wagner, J. C., Sleggs, C. and Marchand, P., "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province," *British Journal of Industrial Medicine*, 1960, 22, 261. By contrast chrysotile mining areas in other parts of the world have exhibited either no excess or a barely perceptible excess incidence of mesothelioma.

Evidence for an important difference in risk in different occupations and with the type of asbestos has increased. The risk is greatest with crocidolite; less with amosite and still less with chrysotile.—*Report of the Advisory Committee on Asbestos Cancers to the Director of the International Agency for Research on Cancer of the World Health Organization*, meeting at Lyon, France October 5 and 6, 1972.

2. Only in occupational exposures do asbestos dust levels appear great enough to become possible health hazards. This fact is related to dosage levels, as pointed out by Enterline and Kendrick: "Asbestos dust at levels to which general populations are exposed probably is of little importance in the etiology (causation) of disease."—Enterline, P. E. and Kendrick, M. A., "Asbestos Dust Exposures at Various Levels and Mortality," *Archives of Environmental Health*, August 1967.

In addition investigators who report so-called "asbestos bodies" in human lungs, note that these findings are not related to cause of death, or indeed to any disease. The comment of Thomson and Graves is representative of those in other studies: "But to convert the scanty or, very scanty bodies which have demonstrated to be present in so many urban dwellers to the frequency present in a minimal basal asbestosis would require an increase by hundredfolds and to get a more diffuse classical asbestosis with pulmonary disability the multiplying factor might well be in many millions." Thomson, J. G. and Graves, W. M., "Asbestos as Urban Air Contaminant," *Archives of Pathology*, May 1966.

"...excess lung carcinoma risk is not detectable when the occupational exposure has been low. These low occupational exposures have almost certainly been much greater than that to the public from general air pollution. There is no evidence of excess risk of mesothelioma from asbestos air pollution which has existed in the neighborhood of chrysotile and amosite mines. There is no evidence of risk to the general public at present."—*Report of the Advisory Committee on As*

*Refer to "History of Johns-Manville Health Research." (Copies available from Johns-Manville)

bestos Cancers to the Director of the International Agency for Research on Cancer of the World Health Organization, meeting at Lyon, France, October 5 and 6, 1972.

3. So-called "asbestos bodies" in the lung may be produced by other substances. Gross et al., have offered experimental proof: "So-called 'asbestos' bodies were produced in the lungs of hamsters injected intratracheally with respirable filamentous particles composed of aluminum silicate... Instead of the term 'asbestos' body, the designation of ferruginous body is suggested." — Gross, P., Cralley, L. J. and deTreville, R. T. P., "Asbestos Bodies: Their Nonspecificity," *American Industrial Hygiene Association Journal*, November-December 1967.

Similar results have been reported by Davis, working at Cambridge University, England. Davis said that hamsters were injected in the trachea and the pleura with dust from aluminum silicate glass fiber, carborundum and man-made textile fiber. "In both injection sites all these foreign materials produced bodies which with the light microscope appeared very similar to asbestos bodies. The basic assumption that asbestos-like bodies can only be produced from asbestos has proved incorrect." — Davis, J. M. G., Gross, P. and deTreville, R. T. P., "Asbestos Bodies and Bioeffects—A Detective Story," *Annual Meeting, Industrial Hygiene Foundation*, Pittsburgh, October 1967.

4. An uninformed speculation, frequently stated as if it were a fact, is that the wearing of automobile brakes releases dangerous quantities of asbestos fiber into the air. A study by Lynch of the U.S. Public Health Service, has demonstrated that this statement is erroneous. Lynch performed laboratory tests of automotive brake linings and found that normal wear releases insignificant amounts of asbestos fiber into the air. He concluded that "the free fibers from brake lining wear appear to be an inconsequential health factor in urban air pollution." — Lynch, J. R., "Brake Lining Decomposition Products," *Journal of the Air Pollution Control Association*.

5. A time factor in asbestosis cases is demonstrated by the study of McVittie showing that clinical asbestosis takes on the average about 17 years to develop. — McVittie, J. C., "Asbestosis in Great Britain," *Annals*

New York Academy of Sciences, December 31, 1965.

6. Selikoff et al., reported a much higher rate of lung cancer among asbestos workers who smoked cigarettes than among cigarette smokers generally. However, they reported not one case of lung cancer among non-smoking asbestos workers. The authors concluded that their evidence "suggests that exposure to asbestos does not lead to an extremely high risk of lung cancer among nonsmokers." — Selikoff, I. J., Hammond, E. C. and Churg, J., "Asbestos Exposure, Smoking and Neoplasia," *Journal of the American Medical Association*, April 8, 1968.

A 1969 update of this study reported one case of lung cancer among nonsmokers — Selikoff, I. J., Hammond, E. C. and Churg, J., "Mortality Experience of Asbestos Insulation Workers 1943-1968," presented at the International Conference on Pneumoconiosis, Johannesburg, South Africa, April-May 1969.

7. Kannerstein and Churg reported in their recent study that lung cancer will not develop in asbestos workers unless they are also cigarette smokers. — Kannerstein, M. and Churg, J., "Pathology of Carcinoma of the Lung Associated with Asbestos Exposure," *Cancer*, American Cancer Society, July 1972.

8. The varying prevalence of mesothelioma in the two crocidolite mining areas of South Africa has prompted comment by Wright: "That something other than, or in addition to, asbestos plays a role in mesothelioma formation seems inescapable." Wright, G. W., "Asbestos and Health in 1969," *American Review of Respiratory Disease*, October 1969.

9. About 50 cases of mesothelioma are reported annually in Great Britain. — Gunter, R., Minister of Labour, *Official Report to the House of Commons*, April 17, 1967.

10. In a study of 76 mesothelioma patients in a London hospital, 25 had no known contact or exposure to asbestos. — Newhouse and Thompson, "Mesothelioma in a London Hospital."

11. In a study of 232 mesothelioma cases in the South African Register, 32 had no asbestos exposure. — National Research Institute for Occupational Diseases of the South African Medical Research Council, *Annual Report*, 1971.

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Report of the Advisory Committee on Asbestos Cancers To the Director of the International Agency for Research on Cancer October 6, 1972

A meeting of scientists comprising the majority of those from all over the world now actively working in the general field of the biological effects of asbestos, was held in Lyon, France at the International Agency for Research On Cancer (IARC), October 5 and 6, 1972.

This scientific group, established as an Advisory Committee to the Director of IARC, consisted of three panels—Epidemiology, Pathology, Physics and Chemistry. The panels first met in separate sessions and at the final collective session, Chairman Dr. J. C. Gilson prepared this report to the Director of IARC:

TERMS OF REFERENCE

1. The Committee was to report on the present evidence relating exposure to asbestos dust to cancers, especially that obtained since the meeting of the UICC Working Group on Asbestos Cancers in 1964.
2. The Committee was to make recommendations for further research and indicate priorities for work of immediate and long-term value.

CO-ORDINATION OF INTERNATIONAL CO-OPERATION

Following the meeting of the UICC Working Group on Asbestos and Cancers in 1964, a Sub-Committee of the UICC Commission on Geographical Pathology and Environmental Carcinogens (Chairman Dr. J. Higginson) was formed to co-ordinate work required to achieve the recommendations.

In April 1970 agreements between the UICC and the IARC led to the winding up of the UICC Sub-Committee and the IARC taking on responsibility for the Sub-Committee's work and extending it by supporting certain projects on asbestos cancers in several countries. The Agency has done this as part of their wider programme of investigating environmental carcinogens. Common memberships between the UICC Sub-Committee and the Committee advising the IARC ensured continuity of policy.

In October 1972 the IARC held an international conference with 137 participants from twenty countries to review all the evidence relating asbestos with cancers. Subsequently the Advisory Committee prepared its report. This is divided into two sections. First, a general review in the form of answers to a number of important general questions about the relation of asbestos to cancers of different sites and, secondly, recommendations for further research.

GENERAL REVIEW

1. Are all major commercial types of asbestos able to cause lung carcinoma?

Yes. Since 1964 the evidence of a casual relationship has been increased by epidemiological studies showing exposure-response relations for the incidence of lung carcinomas. The production of lung carcinomas in certain animals by all types of asbestos supports this conclusion. The epidemiological evidence in man, however, shows that there are clear differences in risk with type of fibre and nature of exposure.

2. Is there evidence of an increased risk of lung carcinoma at low levels of exposure to asbestos, such as have been encountered by the general population in urban areas?



The evidence of an exposure-response relationship based in part on past dust measurements and in part on the type of job within the industry suggests that an excess lung carcinoma risk is not detectable when the occupational exposure has been low. These low occupational exposures have almost certainly been much greater than that to the public from general air pollution.

3. Since 1964 has the evidence relating past exposure to asbestos and mesotheliomas changed?

The evidence has been greatly strengthened by further prospective and retrospective mortality studies in many countries of populations exposed to asbestos. There is evidence that all commercial types of asbestos except anthophyllite may be responsible. Evidence for an important difference in risk in different occupations and with the type of asbestos has increased. The risk is greatest with crocidolite, less with amosite and apparently less with chrysotile. With amosite and chrysotile there appears to be a higher risk in manufacturing than in mining and milling. There is also evidence from population studies that a proportion of cases of mesothelioma have no known association with exposure to asbestos.

4. Is there evidence of an increased risk of mesothelial cancers at low levels of exposure to asbestos, such as have been encountered by the general population in urban areas?

There is evidence of an association of mesothelial tumors with air pollution in the neighborhood of crocidolite mines and of factories using mixtures of asbestos fibre types. The evidence relates to conditions many years ago. There is evidence of no excess risk of mesotheliomas from asbestos air pollution which has existed in the neighborhood of chrysotile and amosite mines. There are reported differences on incidence of mesothelioma between urban and rural areas, the causes of which have not been established. There is no evidence of a risk to the general public at present.

5. Since 1964 has the evidence changed on the importance of other factors such as cigarette smoking, waxes, oils and trace elements as contributory factors to the cancer risk?

The evidence has accumulated indicating:

- a. Cigarette smoking is an important factor enhancing the lung carcinoma risk in asbestos-exposed workers, in both men and women. Asbestos workers have specially strong grounds for giving up smoking to protect their health. No association has been demonstrated between cigarette smoking and mesotheliomas.
- b. Animal experiments designed thus far to test the importance of waxes and oils as contributory factors in the production of mesothelioma have shown these contaminants are unlikely to be relevant.
- c. From animal experiments there are no good clues suggesting that trace elements are likely to be a major factor in the production of asbestos cancers.

6. What other types of cancer are related to exposure to asbestos?

Prospective surveys of occupational groups exposed to asbestos have in general shown a small excess risk of some other types of cancers (in addition to bronchial and mesothelial), especially those of the gastro-intestinal tract. The excess of these tumors is relatively small compared with that for bronchial cancer. Evidence for an association with ovarian tumors has not been supported by the first large mortality survey of women previously exposed to asbestos.

7. Is there evidence of an increased risk of cancer resulting from asbestos fibres present in water, beverages, food or in the fluids used for the administration of drugs?

Such evidence as there is does not indicate any risk.

8. Is there evidence of a risk of lung fibrosis from low levels of exposure to asbestos such as have been encountered by the general population in urban areas?

There is at present no evidence of lung damage by asbestos to the general public. The amount of asbestos in the lungs of members of the general public is very small, compared to those occupationally exposed. It is greatest where asbestos is mined or worked and lowest in rural areas.

9. Has the relationship between asbestos exposure and the development of pleural plaques been established?

Pleural plaques have been associated with past exposure to all commercial types of asbestos. But additional factors, other than asbestos itself, are involved. The plaques may remain fibrous or become calcified. Not all pleural plaques are associated with asbestos.

RECOMMENDATIONS FOR FURTHER RESEARCH

Projects which the Panels rated high in priority are marked *; those which will require close co-operation between the Panels are marked †.

EPIDEMIOLOGY

The Panel agreed that asbestos related cancers occur in several sites in the body. The incidence of the different cancers varies with a number of definable factors and for other reasons, such as competing causes of death. Epidemiological studies will usually provide information on more than one type of cancer. Research directed at only a single type may, on occasions, be useful but in general the inevitable uncertainties, in some cases in the differential diagnosis of, for example, peripheral lung carcinomas and pleural mesotheliomas, and between peritoneal mesotheliomas and other intra-abdominal cancers will require that more than one type is studied at the same time.

The Panel recognized that some of the epidemiological projects could only be pursued if there was close co-operation between epidemiologists, pathologists, physicists and chemists, and others, because their success will depend upon the development of improved techniques, some of which are referred to in the recommendations of the other two Panels.

Projects

1. Further development of objective methods for early detection and surveillance of effects caused by asbestos. Topics for particular study include:

- Immunological techniques for screening for fibrosis and neoplasia.*
- Functional tests of changes in the peripheral airways.*

- Detection of pleural thickening.*
- Assessment of the specificity of small irregular opacities in the chest radiograph as defined in ILO U/C Classification (1971).*
- Tests of the usefulness of different techniques of chest radiography, including the use of 100 mm. films.*
- Development of statistical procedures for analysis and presentation of serial observations.*

2. Evaluation of the usefulness of early detection in the prevention of progressive fibrosis and asbestos cancers, also in the identification of hazardous conditions. Routine health surveillance of industrial populations should be designed to assist epidemiological studies, and should include measurement and recording of environmental dust levels. Surveillance of new entrants could be particularly valuable. Arrangements should be made to register workers so that their morbidity and mortality experience can be studied even after cessation of exposure to asbestos.

3. Assessment of excess cancer risks following exposure to only one type of fibre.

- Chrysotile: The much higher cancer risk reported for chrysotile textile workers compared with mine and mill workers requires explanation. How much is explicable by differences in size of airborne fibres and past dustiness? There is need to make more use of past dust records for relating to indices of disease.*
- Amosite: The excess lung carcinoma and mesothelioma risk is apparently much greater in the manufacturing and application sections of the industry than in the mining and milling of this type of fibre. What are the important factors in this reported difference?*
- Crocidolite: Further studies are required in occupational groups exposed only to crocidolite or amosite or chrysotile in manufacturing and application parts of the industry to establish more clearly differences in risks due to different fibres.*

4. Studies of the amount and type of asbestos in the lungs of cases of mesotheliomas (if possible by cell type) in (a) national survey of mesotheliomas, (b) representative samples of cases arising in groups with a definable past exposure.

5. Studies of secular changes in incidence of pleural and peritoneal mesotheliomas nationally and internationally.

6. Epidemiological studies to investigate the association between past exposure to asbestos and cancer of sites other than lung, pleura, and peritoneum.

7. Studies of secular trends in the asbestos content of the lungs in the general population.

8. Studies to relate amount and type of asbestos in the lung and estimates of past dust exposure and interval since last exposure.

9. Experimental and epidemiological studies to investigate possible differences of effect of continuous low and intermittent high exposure to asbestos.

10. Opportunities afforded by intercurrent deaths should be used to interrelate radiographic appearances, lung pathology, respiratory function, dust content, and type in asbestos workers. Standardized techniques and classification recommended by the Panels should be used.

11. Investigate the prognostic significance and aetiological factors in the development of calcified and uncalcified pleural plaques in different environments.

12. Investigate talc-exposed groups in mining and manufacturing to establish any differences in morbidity or mortality which might be related to the amount and shape of the fine respirable particles.

13. Development of cost/benefit analyses to study the health, safety, social and economic interrelations of the use of asbestos.

PATHOLOGY AND EXPERIMENTAL PATHOLOGY

The Panel reviewed the progress made on the

1964 UICC recommendations. It was agreed that considerable progress had been made on the majority of the recommendations. Some require further study, or modification of previous methods of investigation; these are included in the list of recommendations that follows. The recommendations are divided into three categories; morbidity anatomy and histology, clinical research, and experimental studies.

PROJECTS

Morbid Anatomy and Histology

1. Asbestosis

- * a. Further consideration should be given to methods for determining the amounts, types and structural features of asbestos in tissue. A Sub-Committee should be established with members of the Physics and Chemistry Panel, and others to accelerate work on this problem.
- b. The methods for assessing the severity of asbestosis (See Paper 9) should be tested for consistency by different observers.

2. Carcinoma

- *† a. An investigation of whether reduction of asbestos exposure to levels below those producing asbestosis also abolishes excess risk of carcinoma was considered important.
- b. A comparison of lung carcinomas in persons occupationally exposed to asbestos and those not so exposed, including both cigarette smokers and non-smokers, in respect of sites of origin and cytology of tumors and presence or absence of asbestosis, would be of value.

3. Mesotheliomas

- a. The International Panel of Pathologists¹ and National Panels established following the 1964 meeting² have served a useful purpose. It is recommended that panels be established in other countries and membership of the International Panel be extended. The main purpose of these Panels is to ensure uniformity of diagnostic criteria and recording of histological types of diffuse mesotheliomas.

¹The International Panel consists of: Dr. M. Kannerstein (USA), Prof. D. Magner (Canada), Dr. L. Meurman (Finland), Prof. W. T. E. McCaughey (Ireland), Prof. H. Otto (FRG), Dr. H. Planteydt (Netherlands), Dr. E. Roitzsch (GDR), Prof. L. Santi (Italy), Prof. I. Webster (South Africa), and Dr. J. C. Wagner (UK) as Secretary.

²Great Britain, South Africa, United States, Canada, Netherlands.

Collaborative study of histology slides in National Panels is recommended. The diagnosis of mesothelioma can be made by exfoliative cytology of the pleural fluid. If the cytological diagnosis is made by a competent cytologist, biopsy may be unnecessary.

b. To improve consistency of diagnosis there is an urgent need for a Comprehensive Atlas on mesotheliomas, or alternatively, for inclusion of an enlarged section on mesotheliomas in the new edition of the WHO Monograph on Tumors of the Lung. Criteria for diagnosis by exfoliative cytology and a description of the fine structure of mesotheliomas should be included.

Clinical Research

*† 1. Monitoring by immunological methods of populations exposed to asbestos should be investigated to ascertain whether it is possible to recognize those who are developing, or will develop, tumors.

2. The use of chromatographic methods for the study of mucopolysaccharides and other tumor-associated substances in pleural fluids should be explored. Sensitive methods might be developed and applied to identify secretory products of mesotheliomas in blood and urine.

Further Experimental Studies

* 1. Information is required about the role of fine particles, especially influence of fibre size, in the induction of tumors. These studies should be extended to include fibres other than asbestos. A Sub-Committee should be established to review the need for, and arrange the distribution of standard samples of asbestos and other fibres in addition to the UICC Reference Samples.

† 2. The fate of inhaled particles of various sizes, shapes and chemical compositions, should be studied to determine more precisely the quantities and sites of initial deposition, change within the body and later retention. The feasibility of increasing fibre elimination by various methods should be explored. Studies should be made of means of reducing the fibrogenicity and carcinogenicity of fibres already retained in the lungs.

3. The use of cell and organ culture, including mesothelial tissue from man and other species, should be further investigated with a view to developing methods of screening dusts for fibrogenic and carcinogenic properties.

4. Further studies should be carried out to determine the nature of the combined effect of tumor induction when animals are exposed to asbestos dust and cigarette smoke, metals or other chemical carcinogens, including those which act systemically such as nitrosamines.

5. Inhalation experiments should be extended to test various types of fibre; of special interest are forms of chrysotile and crocidolite including the finer grade materials.

6. It was felt that studies of the pathological effects of asbestos on species other than rodents would be of value.

7. The effect of long-term ingestion of fibres of various sizes, shapes and chemical compositions should be studied.

8. The effects of fibres and associated metals on the metabolism of target organs should be investigated.

PHYSICS AND CHEMISTRY

The Panel reviewed the progress made on the 1964 UICC Recommendations. The proposals for the preparation and characterization of the UICC Reference Samples of asbestos had been satisfactorily implemented, and the Panel recommended that a list of references to papers featuring the samples should be distributed to investigators in this field. Considerable progress had been made on methods of identifying the type of fibre in tissues but a quantitative method when several types of fibres were present had yet to be developed.

The Panel discussed the further contribution that physical and chemical studies can make to research on the biological effects of asbestos and other fibrous materials. Of especial interest are the effects of fibre size and shape on the retention of material in the lungs, the site of deposition, the migration of fibres within the body, and their carcinogenic or other biological activity. The following recommendations were made:

PROJECTS

***†1. Materials for experimental work**

- a. Supplies of asbestos from relevant sources should be obtained where there is evidence of variation in geological form, trace element content or significant biological findings.
- b. Small samples of various fibrous materials should be prepared for studies on the influence of fibre size and shape on carcinogenicity. For this purpose the samples should be milled to different degrees of fineness.
- c. For investigations on the influence of particle shape and size, on the inhalation and subsequent fate of asbestos fibres a chrysotile and an amphibole of fibre length greater than the UICC samples should be prepared.

***†2. Methods**

- a. There is an urgent need for the quantitative assessment, size analysis and characterization of particles and fibres in the lungs and other organs. Details of available methods should be circulated, international comparisons undertaken, methods standardized and new techniques developed.
- b. No methods are at present available for the preparation of fibres in narrow ranges of diameter and length in sufficient quantities for inoculation experiments. Techniques for these purposes are urgently required, especially in view of the advantages such graded samples could provide for investigating the influence of these physical factors on the carcinogenicity of fibres of different materials.
- c. Since the degree of dispersion of fibres (especially chrysotile) used in inoculation studies may have a marked influence on their carcinogenicity, methods are required for quantifying dispersion.
- d. Inhalation studies require precise control of the characteristics of the dust clouds. Improved methods of dispensing fibrous dusts in such

investigations need to be developed.

e. Methods are available for collecting the important size fractions of dust clouds in inhalation studies when the particles are of compact shape. Similar methods must be developed for fibrous particles.

f. The present membrane filter methods of measuring the levels of airborne asbestos dust require standardization. This should be done by inter-laboratory trials on a continuing basis. Particle counting by electron microscopy should also be developed. Gravimetric assessment methods and the automation of particle counting should be explored.

3. Inhalation Studies

Considerable information is now available on the deposition, retention and migration of particles of compact shape. Recently developed methods, especially radio-active tracer techniques, should be used to obtain similar knowledge for fibrous particles. This information is needed to identify the biologically important size fraction and to help interpretation of epidemiological and pathological studies.

4. Occupational and Environmental Studies

The use of both fibre counts and gravimetric methods for assessing asbestos dust concentrations should be encouraged. Data collected over an extended period will be particularly valuable in identifying the parameters of the dust which can be correlated with epidemiological evidence on the health hazard.

5. Physics and Chemistry Panel

It is recommended that an international Panel be established to assist in implementing these recommendations. The Panel would periodically review requirements for materials for experimental work; provide guidance on physical and chemical problems; and arrange national and international standardization trials.

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